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Overview

This manual covers the Indigo GUI interface, and Indigo scene attributes and functions.

There are some package-specific details that are not included here, but rather in their respective plug-in manuals.

There are two other Indigo manuals available, the Indigo Techniques Manual, which shows techniques on how to use Indigo to get beautiful renders, and the Indigo Technical Manual which gives all Indigo functions – useful reference for writing exporters.

About Indigo Renderer

Indigo Renderer is a stand-alone unbiased renderer. It takes 3D scenes generated in a modelling package and creates a photo-realistic visualization of the scene.

About unbiased rendering:

Indigo uses unbiased rendering technologies to create the most absolutely realistic visualization possible with current technology. Unbiased rendering means that Indigo uses the equations that model the behaviour of light, with no approximations or guesses taken. By accurately modelling all the interactions of light, Indigo can produce effects such as:

- Depth of Field – the depth of field (DOF) is the portion of a scene that appears acceptably sharp in the image.
- Spectral effects – as when a beam of light goes through a prism and a rainbow of colours is produced
- Refraction – as when light enters a pool of water and the objects in the pool seem to be "bent"
- Reflections – from subtle reflections on a polished concrete floor, to the pure reflection of a silvered mirror
- Caustics – as in light that has been focussed through a magnifying glass and has made a pattern of brightness on the floor

As the unbiased technique requires no approximations or user preferences to generate a realistic image, you can accurately discover what something will look like before it is built. If you are used to using older "global illumination" renderers, you will find that Indigo requires less set up and configuration to get good quality renders.

Indigo is easy to set up, predictable and produces amazing quality renders.

As with all things good – there is a downside, and with unbiased rendering techniques, the problem is that rendering is more computationally intensive. A high-quality render of a complex scene at 2 Megapixel resolution may take up to 5 hours on modern hardware. In the general case however, most renders can be completed in less than 30 minutes, and Indigo allows you to utilize network rendering to speed up the render. See the sections on 'system requirements' and 'network rendering' for more information about speeding up your renders.

When you start your first render with Indigo, you will notice that the image will be produced quite rapidly - you will be able to see the outline of the scene within 20 seconds of starting the render – but it will be quite noisy.



As time goes on, the image will become clearer and clearer. In this case, the render took 3 minutes to produce the following image:



This is a characteristic of unbiased rendering. The first image is akin to the graininess you get when you take a photo of a dark room with an exposure that is too short. The problem is that not enough light has been simulated to create an accurate representation of the scene. On the plus side, you get to see instantly whether your render settings are correct, and if the render is looking good you can just leave Indigo to render for longer.

About Exporters:

Indigo is designed to be independent of the modelling package you use, and uses its own file format, called an Indigo Scene File (.igs extension). To create an .igs file, you need to use an *Exporter*, a plugin for your modelling package that can output .igs files.

The exporters are complex pieces of software in their own right and it is recommended you read your exporter manual after you have finished looking through this document.

At the time of printing, Indigo has exporters for the following software:

- 3ds Max
- Blender
- Cinema 4D
- Google Sketchup

If your modelling package of choice is not listed, it is often possible to export your scene or 3D model into a format that can be loaded by one of the above packages and then exported to Indigo. Blender is often a popular choice for doing this – since it is a powerful and free modelling package.

Licensing Indigo

The development of Indigo began in 2004 and for the first five years of its life, Indigo was freely available via the internet. Beginning with Indigo 2.0, released in 2009, Indigo is a commercial software package and requires a licence if you want to use Indigo for commercial work – or remove the restrictions put on the free version.

You are welcome to learn Indigo 2.0 and use it for non-commercial renders without paying for a licence. The following restrictions are present in the free version of Indigo:

- Maximum resolution of 0.7 Megapixels – e.g. 1000 pixels by 700 pixels.
- Indigo logo in the bottom right of the image
- **May not be used for commercial work.**
- No support (beyond that given in the forums at indigorenderer.com/forum/)

If you need to create renders at higher resolutions or produce renders as part of your business, then you need to buy a commercial licence for Indigo. You can buy licences online at:

http://store.glaretechnologies.com/

Once you have purchased a licence, you can instantly enable the full features of Indigo. Your licence will be locked to the hardware of your computer - but if you upgrade your computer in the future, you can ask to have your old licence invalidated, and you can generate a new licence for your new computer.

The licence for your computer is based upon the CPU model of your processor and MAC address of your network card. You should avoid changing your network card regularly when using Indigo – for example avoid enabling and disabling your network card, as this may confuse the licensing software that Indigo uses.

If you have any problem with your Indigo licence, you can always contact us at support@indigorenderer.com and we'll get you up and running as soon as possible!

There are two different kinds of Indigo licences:

- GUI Licence – for use on your desktop computer
- Node Licence – for use on networked render slaves

Having a GUI Licence does not mean that you can use unlicensed render slaves to generate a high resolution image, you will need a node licence for each computer that will be used to help you render your image.

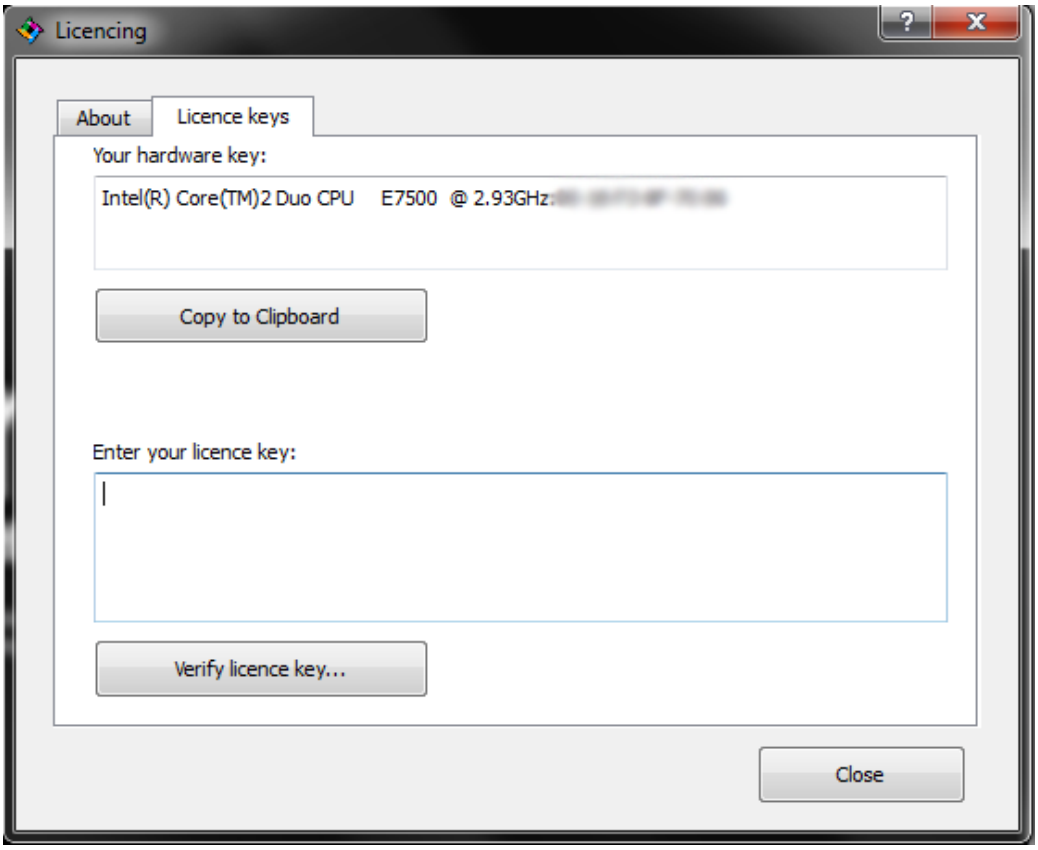
Indigo Licence activation

Once you have purchased an Indigo Licence from the Glare Technologies Store you need to go through a few steps to activate it with Indigo.

1. Open Indigo and click on the **Licencing** button.

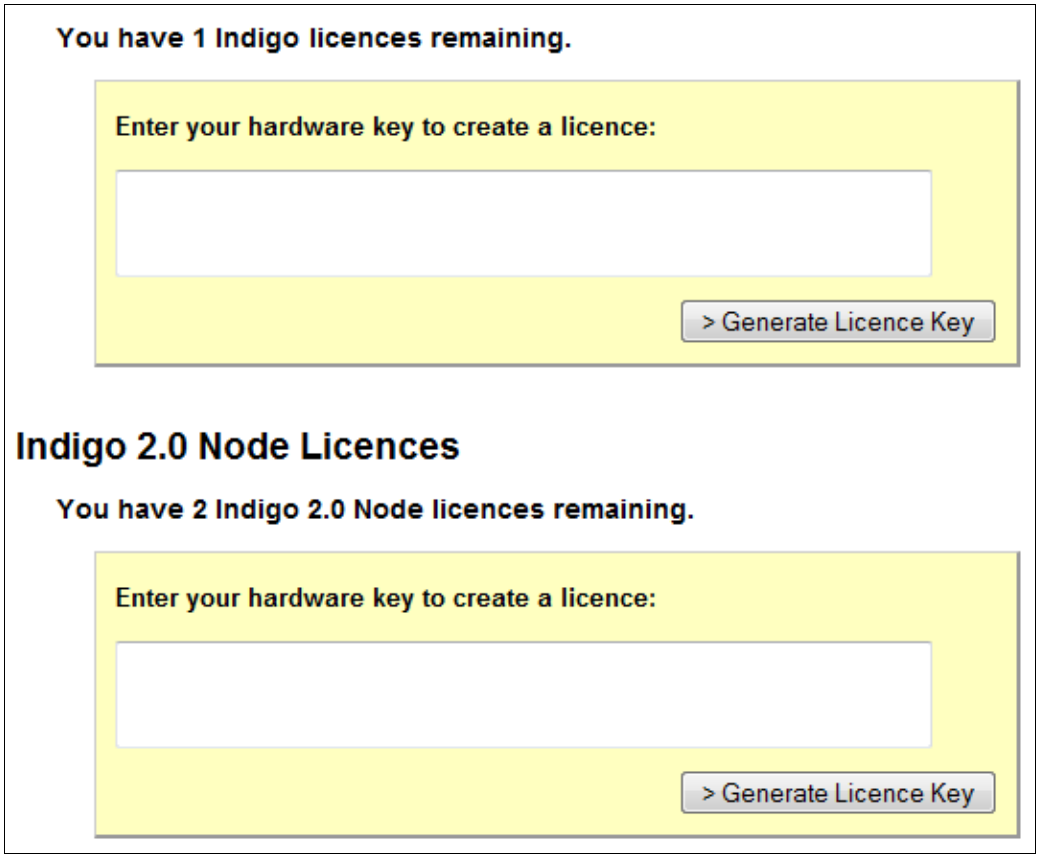


2. Press **Copy to Clipboard** to copy the hardware key.

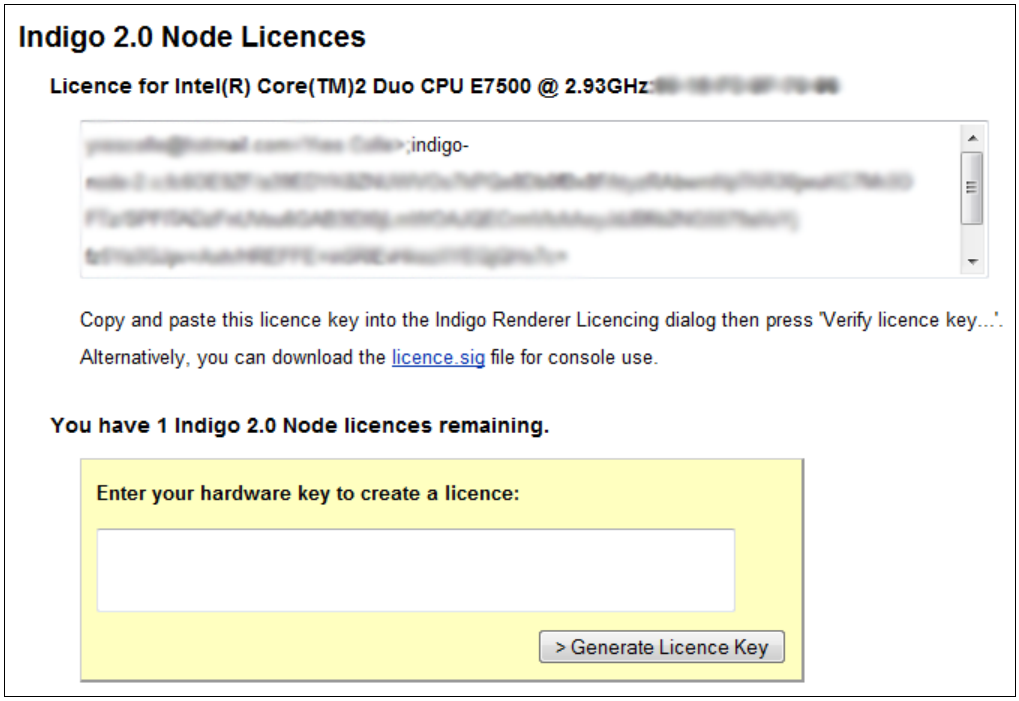


3. Upon purchase on a licence, you will receive an email with a link to the store page with your details on it. Check they are correct.

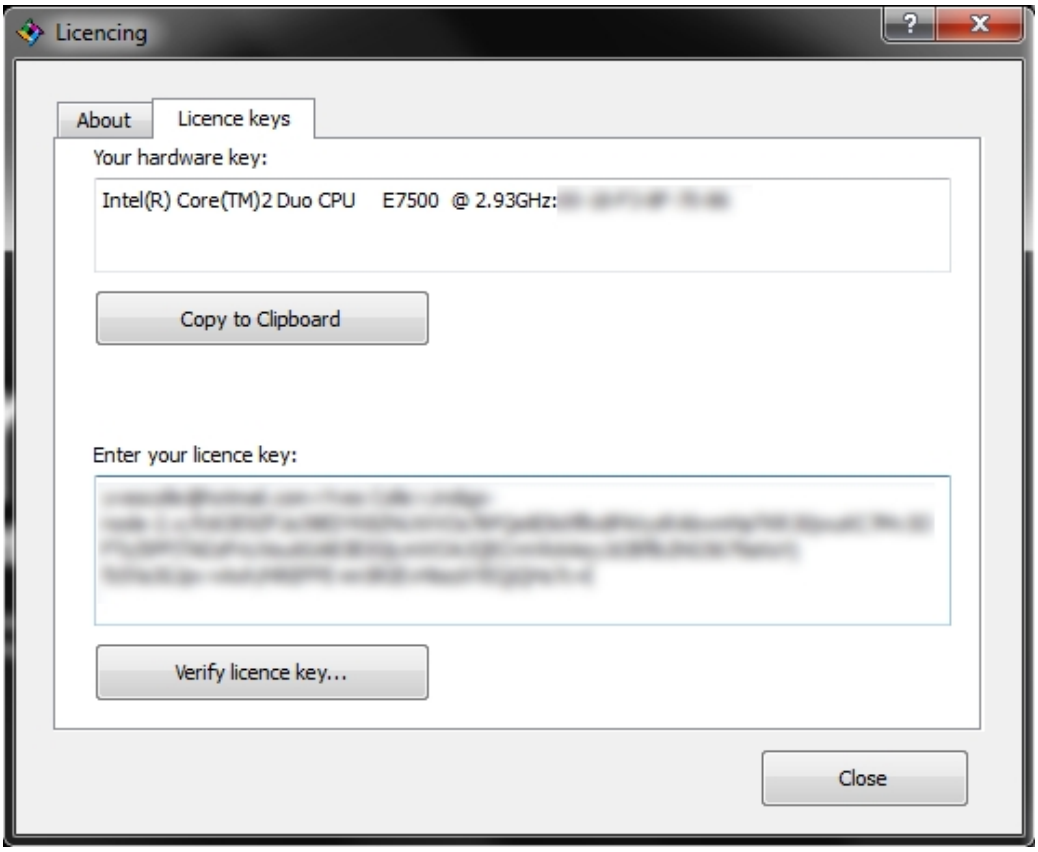
4. Scroll down to the bottom section. Paste in your hardware key into the appropriate box, depending on the type of licence you own, and press **Generate Licence Key.**

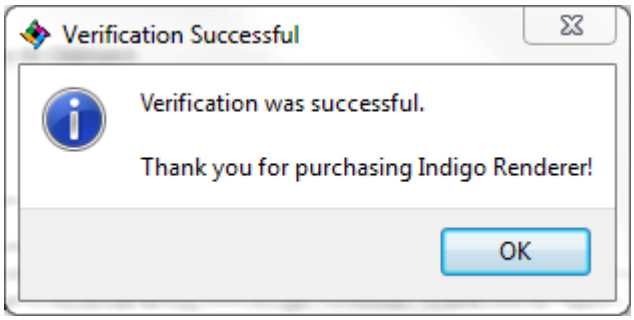


5. A bunch of characters will be returned in a text box, copy it all.



6. Paste it back into the Indigo Licence dialog box at the bottom. And press **Verify licence key.**





Success!

7. The Indigo background will also tell you if it is verified.



System Requirements

Indigo will run on most modern computers.

Minimum system requirements:

Windows:

- Pentium class CPU with SSE2 – anything purchased in the last 5 years should satisfy this requirement.
- 1GB of RAM
- 100MB of Hard drive space
- Windows 98 or above

Mac:

- Intel Macintosh – PowerPC based macs (G4/G5) are not supported
- 1GB of RAM
- 100MB of Hard drive space
- OSX 10.5 Leopard

Linux:

- CPU with SSE2
- 1GB of RAM
- 100MB of Hard drive space

Recommended systems

To get the best results from Indigo when rendering large scenes, you should look at getting a computer with multiple cores (e.g. the Intel Core 2 Quad or Core i7 CPU) and at least 2GB of RAM.

If you are rendering exceptionally large scenes you may require 4GB or more of memory – in this case you should use a 64-bit build of Indigo and a 64-bit operating system so that Indigo can access all of your memory. See the notes on 32-bit versus 64-bit in the next section.

About Installation

To download Indigo, go to http://www.indigorenderer.com/download/ and select the appropriate version of Indigo for your platform (Windows, Macintosh or Linux). You should download the latest available version of Indigo which will be listed at the top of the page.

32 bit versus 64 bit

Indigo is available for each platform in 32-bit and 64-bit versions. If you have a 32-bit CPU or 32-bit operating system you can only use the 32-bit version of Indigo. If you have a 64-bit CPU and operating system (e.g. Windows XP 64 bit, Windows Vista or OS X Leopard) then you can use the 64-bit version of Indigo.

The 64-bit version of Indigo has the following benefits:

- Ability to access more than 2GB of memory
- Slight performance increase on 64-bit CPUs

The 64-bit version of Indigo for your platform is available under the 64-bit builds section on the Indigo download page:

http://indigorenderer.com/download/

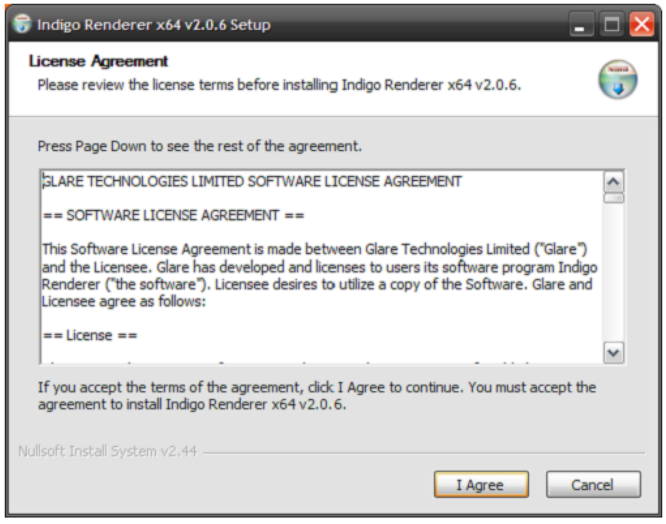
It is free to upgrade to the 64-bit version of Indigo.

Installation on Windows

Download the newest version of Indigo for windows, then double click the installer file.

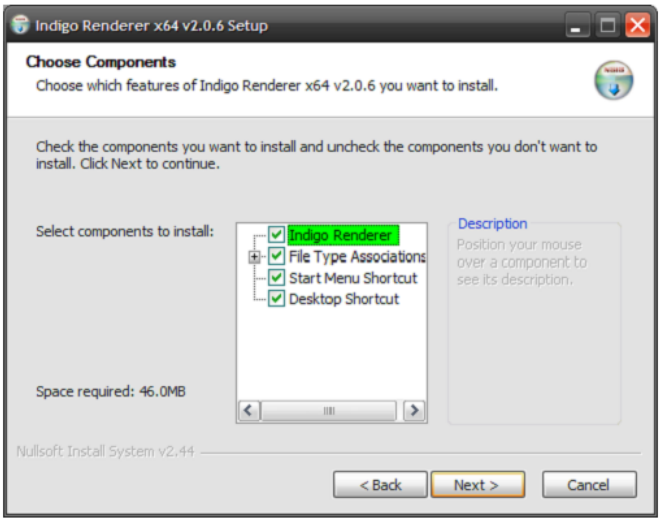
Step 1 – Agree to the licence

You will be presented with the Indigo End User Licence Agreement. You should read through it and click 'I Agree' if you agree with the terms.



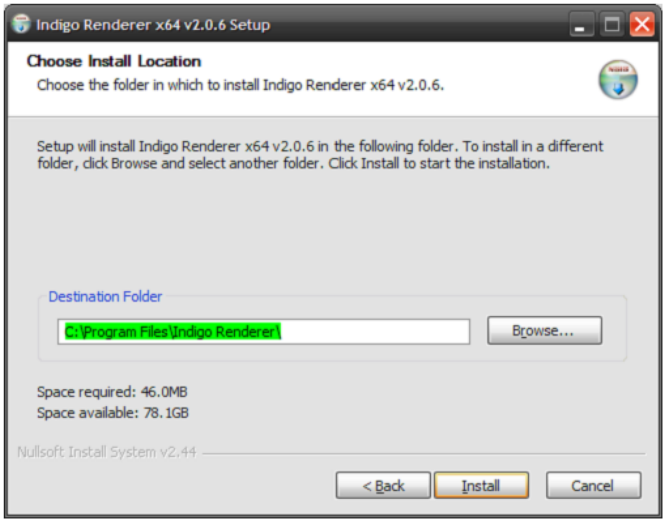
Step 2 – Choose Components

We recommend you leave the checkboxes selected but you are able to disable each component if you have special needs on your system. Press Next to continue.



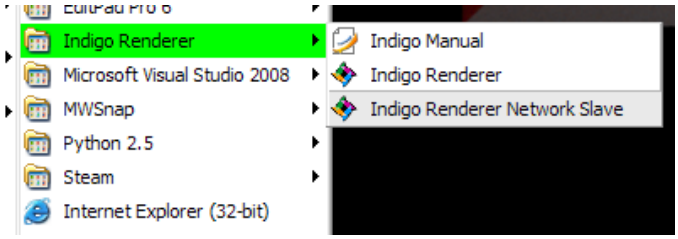
Step 3 – Choose Install Location

We recommend you use the default installation location, as most Indigo exporters will expect to find Indigo here – however you are able to change this path if you need. Indigo will write a registry key that exporters will use to find Indigo automatically if Indigo is installed in a non-standard location. Press Install to complete the installation.



After Installation

Once installation has completed, you can find Indigo in the start menu under the Indigo Renderer menu..

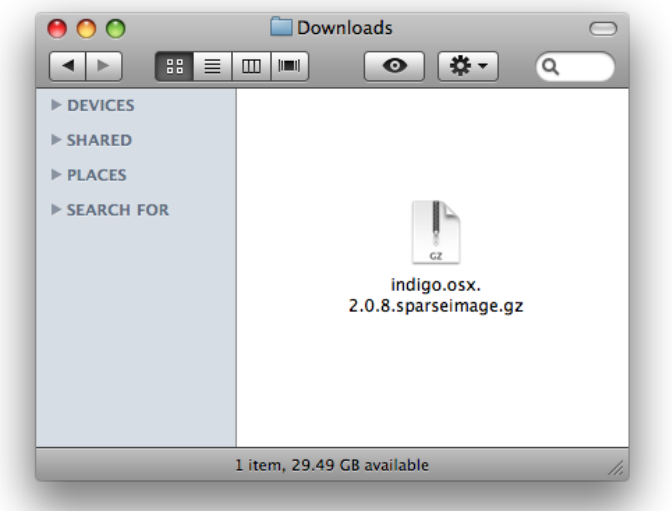


This manual is available as *Indigo Manual*, you can start the Indigo Renderer GUI with the *Indigo Renderer* entry or start the *Indigo Renderer Network Slave* if this PC is to be used as a network rendering slave. See the relevant exporter manual to get started with your modelling package.

Installation on Macintosh

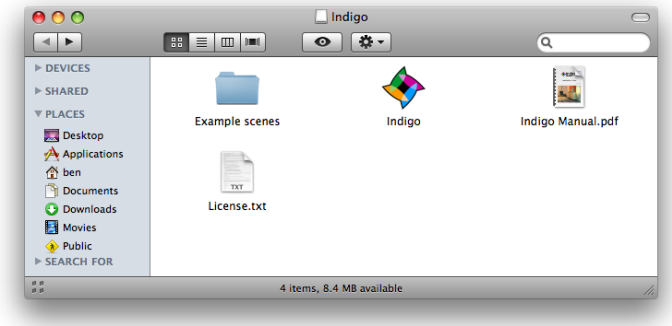
Step 1

Download the newest version of Indigo for Macintosh then double click the download file to unzip it.



Step 2

Double click the file that is unzipped to mount the Indigo disk image.



Step 3

Drag the Indigo icon to your applications directory to copy it to applications. Indigo is now ready to be used on your mac.

Installation on Linux

Step 1

Ensure you have correct prerequisites. Indigo on Linux requires that you have qt-4.5 installed for the GUI. This library is available for most modern distributions and can usually be installed with rpm or aptitude.

Step 2

Download the latest indigo .tar.gz file from
http://www.indigorenderer.com/download

Step 3

Create a folder in your home directory and unzip the .tar.gz into that directory. Indigo is statically linked as far as possible and should be ready to be used. Run ./indigoconsole -h to see if Indigo installed correctly.

You are now ready to run Indigo.

Installing exporters for your modelling package

As described in the *About Indigo* section, Indigo requires an 'exporter' to work with each modelling package. You can download these exporters at:

http://www.indigorenderer.com/download/

In the *Download Exporters* section. Each exporter will come with its own installer and should automatically detect the location of Indigo.

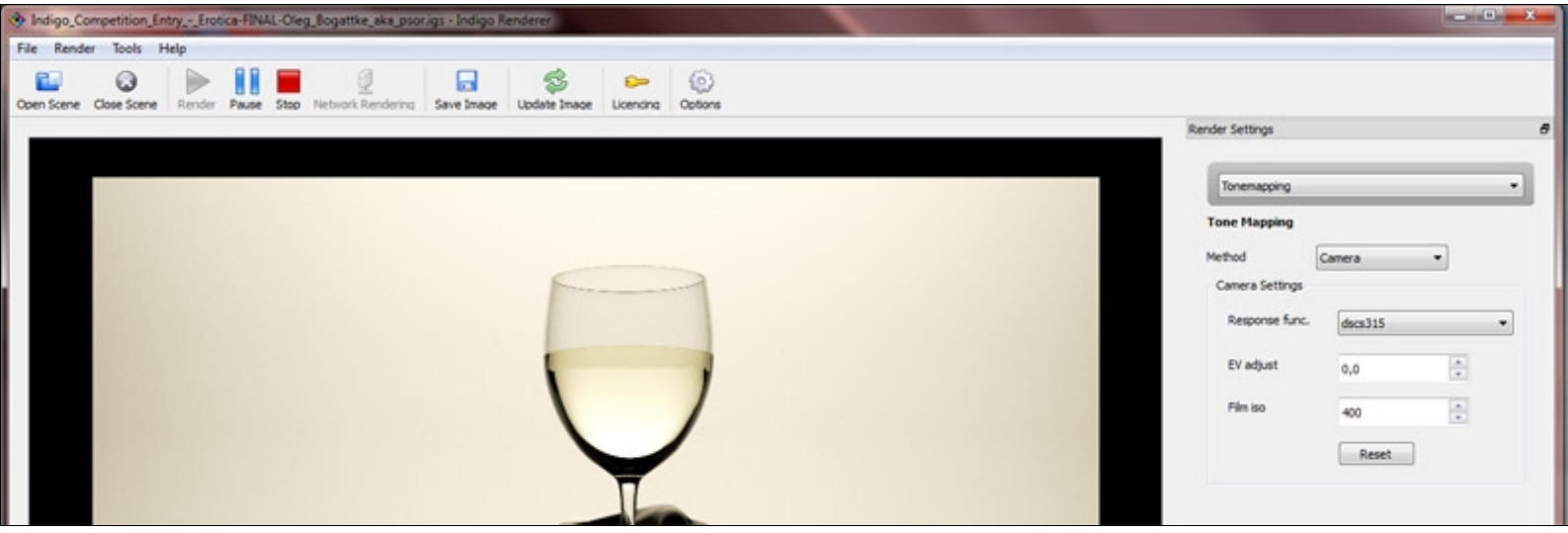
Notes about exporters:

- You need to install Indigo before you install the exporter for your modelling package.
- If are are getting strange errors with Indigo complaining about not being able to render your scene file, ensure that you have the same version of Indigo (e.g. 2.0.7) as your version of the exporter (e.g. Blendigo 2.0.7).

Further information about using the Indigo exporters you should see the relevant *Exporter Manual*.

Working with the

Indigo Interface



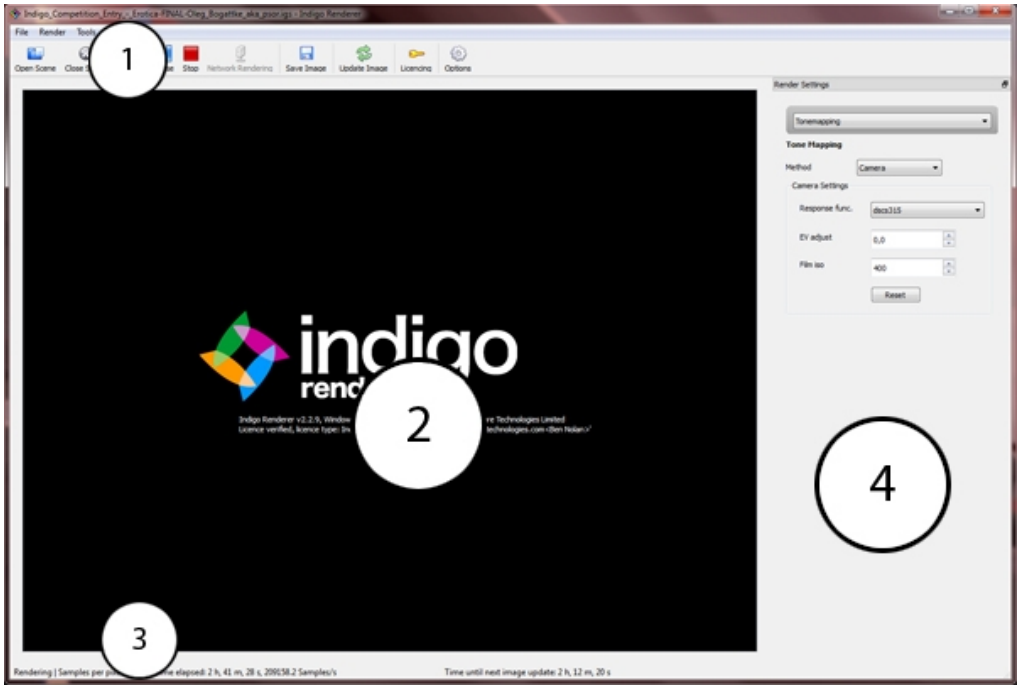
Getting to know Indigo

Note: The screenshots in this section of the Indigo manual are taken from the Windows 7 version of Indigo – the GUI may look different on your system but should act identically.

A first look at Indigo

To get started. click *Open Scene* and browse to the *testscenes directory* in your *Indigo Renderer* directory. Open the scene *\Caterpillar - Paha Shabanov\caterpillar_5.igs* This will let you see all of the Indigo user interface elements.

The Indigo window is divided into four sections:



1. Toolbar – Open and close scenes, start and pause rendering, save rendered image and more.

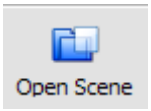
2. Rendering frame – This section will show the Indigo logo and your licensing information. Once rendering has started, the rendered image will be shown here.

3. Statusbar – The statusbar shows your progress of the render.

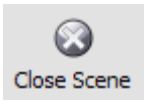
4. Render settings – This section is only available when you have an open scene. You can use these settings to modify the scene settings and modify the image settings as the render progresses.

1. Toolbar

Most functionality in Indigo can be accessed from the toolbar. Each option in the toolbar is also available from the Indigo menu bar.



Open Scene
Opens a new scene in the current window. Closes currently open scene (if any).



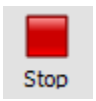
Close Scene
Closes the current scene, terminating the current render. Ensure you have saved your output image before closing the scene.



Render
Start rendering the current scene. Upon pressing this button, the scene will be processed and then rendering will start. The scene building process can take up to a minute on large scenes.



Pause Render
This will pause the current render and free up your computers CPU. You can resume the render at any stage. You may need to do this if Indigo is causing your system to slow down while rendering.



Stop Render
This stops the current render and frees your computer's

CPU and memory. You can still tone-map and save the rendered image after the render has been stopped – but you cannot easily restart the render (see more information about .igi files if you need to stop and start renders).



Network Rendering

Enables network rendering. This button must be pressed before *Render* is pressed to start a network rendering job. See the section on *Network Rendering* for more information.



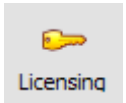
Save Image

Once an Image is rendering, you can click Save Image to save the image that is currently being displayed in Indigo.



Update Image

Indigo only updates the image on the screen every minute (by default), to speed up your rendering time. If you want to see the progress that has been made since the screen was last updated, you can press Update Image to force a screen update.



Licensing

Use this button to open the licensing window. You can use this to instantly buy a licence for Indigo and remove the restrictions of the free version.

2. Rendering frame

The render frame shows the progress of your rendering. It will resize to the size of the render you are rendering currently. To zoom in or out on the image, click on the rendering frame and press + to zoom in, - to zoom out and press 0 to reset to the 1:1 zoom level, you can also use the mouse scroll

wheel to zoom in/out

3. Statusbar

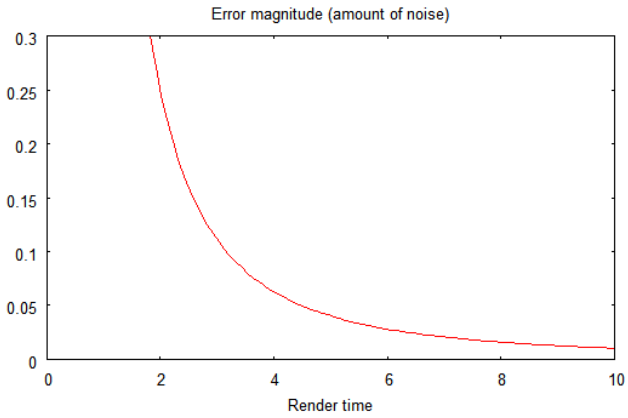
The statusbar shows render progress. It displays samples per pixel, time elapsed and the total number of samples.

About samples per pixel

Indigo measures its render progress as the number of samples that have been calculated. You can imagine these as being the number of "light particles" that have bounced around the scene and hit the sensor in your camera. Depending on the complexity of your scene, it may take up to 1000 samples per pixel before the image starts to become clear enough for your purpose. Many scenes will start to resolve at around 100 samples per pixel, and some scenes look good after 10 samples.

How long do I render for?

Unbiased renderers (like Indigo) are never truly "finished" rendering. You will get your first image from Indigo within 30 seconds of starting your render, but this image will be very noisy (lots of "grain" or "static" in the image). As the render progresses, the noise in the image will go down according to the following graph:



So, at the start of the render, the amount of noise in the image will decrease very fast – if you watch the render you'll notice it gets visibly clearer in the first 5 minutes. However, over time - the quality of the render improves

more slowly, until eventually you will not get any noticeable difference from rendering any further.

In general, most people will just leave their scene rendering until it looks clear enough for their purposes.

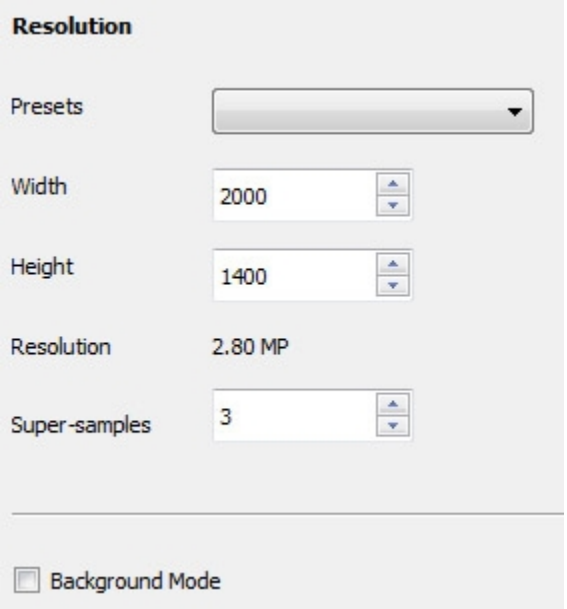
4. Render settings

The render settings are only visible when a scene is open. There are several pages of render settings – you can access the different pages via the drop down control:



The pages of render settings are described in the following sections.

Resolution



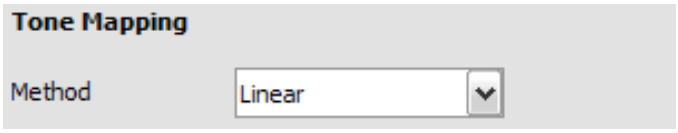
The resolution page controls the size of the image you will create. You can specify the resolution from one of the presets, or enter it manually in the width and height controls. The resolution will be calculated and displayed in Megapixels (the same measurement used for digital cameras description).

Higher resolutions will take longer to render to a good quality.

Background Mode is an option that is only available on windows. It specifies how much of your CPU that Indigo is allowed to use. This will make your computer more responsive for normal usage, while Indigo will continue running (slightly slower) in the background. This is useful if you need to use your computer for other tasks while Indigo is running.

If Super-Samples is greater than 1, then the image is rendered at a higher resolution internally, then downsampled using the downsize filter before the render is saved to disk. This can help to reduce aliasing around high contrast edges. Note that higher factors require more memory (RAM).

Tone Mapping



Tone mapping changes the brightness and contrast of your image. It can be done at any stage during the render process. Changes to tone mapping will be applied immediately to the rendered image. Tone mapping is non-destructive, so you can play around with the different tone mapping settings without permanently effecting the rendered image.

You may want to tone map your image using different settings, and press Save Image to save out several different images.

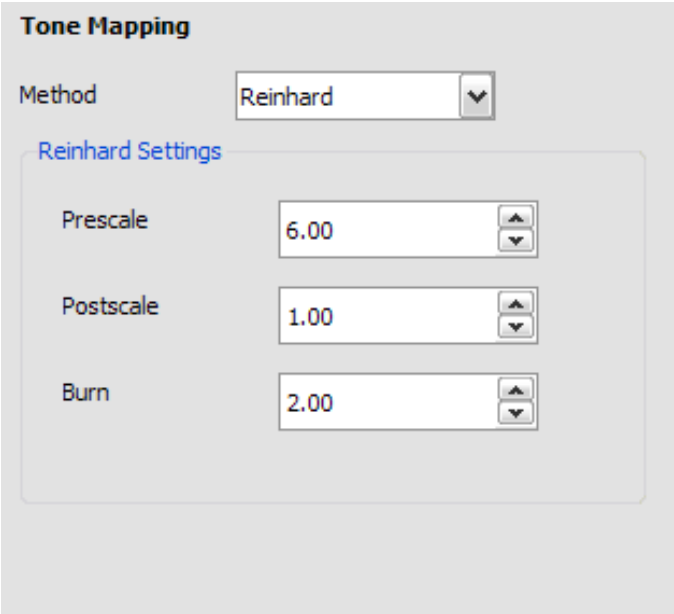
Some background: Indigo creates a high dynamic range (HDR) image as it renders, and this must be converted to a standard low dynamic range red, green and blue image that can be displayed on your computer monitor or saved as an image.

Tone mapping can be a slow process on high resolution images (especially if aperture diffraction is turned on) and so tone mapping is only done periodically to ensure that Indigo can dedicate most of it's time to tracing the light paths inside your scene.

Indigo has three different tone mapping techniques that you can choose from: Reinhard, Linear and Camera.

Reinhard is the simplest to use as it automatically scales to the brightness of your render. Once mastered however, camera tone mapping can give a nice artistic feel to the renders.

Reinhard tone mapping



Reinhard is a method based on a paper by Reinhard, Stark, Shirley and Ferwerda from the University of Utah. It is often the best tone mapping technique because it automatically adjusts to the amount of light in the scene.

It can be tricky to get linear or camera tone mapping to work correctly in scenes where there is an extremely bright light source – the Reinhard method is a good choice for scenes like this.

The parameters of Reinhard are hard to explain, as they represent parameters for this formula:

$$L_d(x,y) = \frac{L(x,y)}{1 + V_1(x,y,s_m(x,y))}$$

Luckily, the default Reinhard settings of prescale=6, postscale=1, burn=2 will result in great results for all Renders. If you do want to adjust the Reinhard method – here is an approximate description of each parameter.

Prescale Similair to a contrast control, works by increasing the amount of light in the HDR buffer.

Postscale Works like a brightness control, increases the absolute brightness of the image after it has been tone mapped.

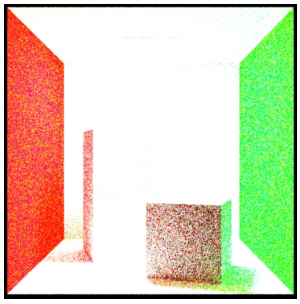
Burn Specifies the brightness that will be mapped to full white in the final image. Can be thought of as gamma control.

We recommend that most people use Reinhard with it's default settings.

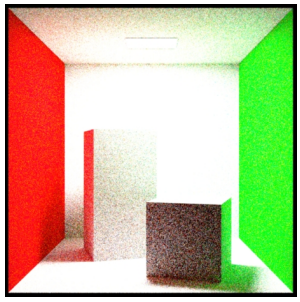
Linear tone mapping



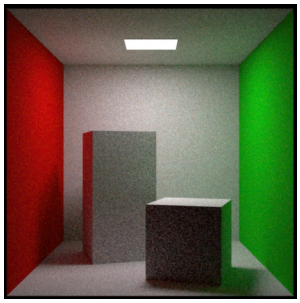
The simplest tone mapping method, linear depends on just a single number. Every pixel in the HDR image will be multiplied by this number.



Scale = 1.0



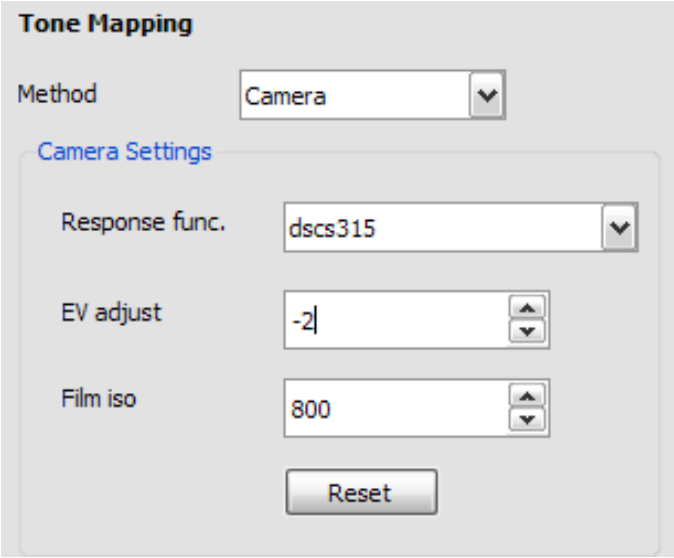
Scale = 0.1



Scale = 0.01

Linear is easy to understand, but doesn't give the best results – the Reinhard and Camera methods tend to give a nicer feel to the image. For example – linear will be hard to configure when there is a bright light source visible (such as the sun) while the rest of the scene is dimmer.

Camera tone mapping



Camera tone mapping simulates the working of a photographer's camera. You adjust the exposure and ISO settings as you would in a real camera to modify the tone mapping.

The parameters you modify are:

ISO The ISO number represents the speed of film that is used. The higher the ISO number, the more light will be collected in the HDR Image. In low light situations, a fast film should be used, such as ISO 1600, and in bright lighting situations, a slow film can be used, such as ISO 100.

EV The exposure value can range from -20 to +20 and represents a correction factor that is applied to the collected light. The higher the EV, the brighter the final image will be. Increasing the EV by one will make the image twice as bright.

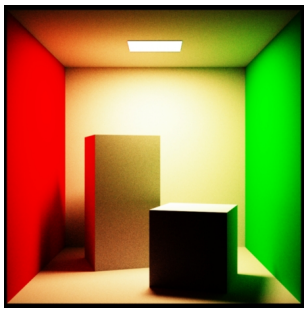
The final parameter is the response function. This specifies the type of film or digital camera to emulate. Different films and cameras emphasise different colours. The response functions are taken from real cameras – for example the images below use Ektachrome 100CD film which is famous for being used by National Geographic in their older photos.

A good default for sunny well-lit scenes is an ISO of 200 and an EV of -5.0.

Camera tone mapping using Ektachrome 100CD film, and an EV of -6.0:



ISO = 100

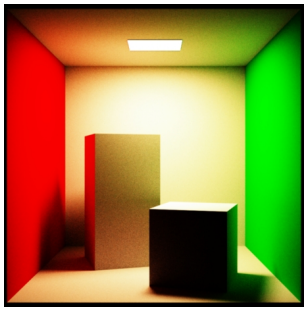


ISO = 200

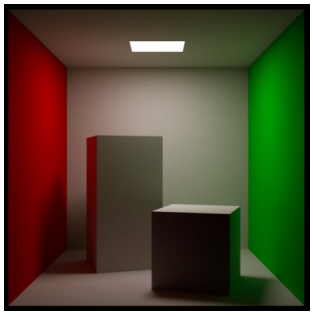


ISO = 400

Camera tone mapping using ISO 200, EV of -6.0 and different response functions:



Ektachrome 100CD

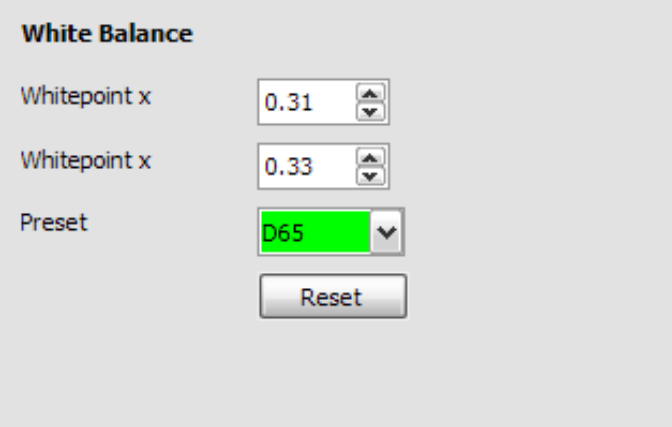


Advantix 100CD



DSCS315_6

White balance



White balance is used for the same reason as in traditional photography. The human eye and brain adjust to the light in a situation to make the whitest colours look true white. For example, a sheet of white paper will appear white outdoors, where there is a lot of blue light, as well as appear white indoors under incandescent bulb lighting, where there is a lot more orange and red light. When rendering, you can adjust the whitepoint so that the scene doesn't have a blue or yellow tinge.

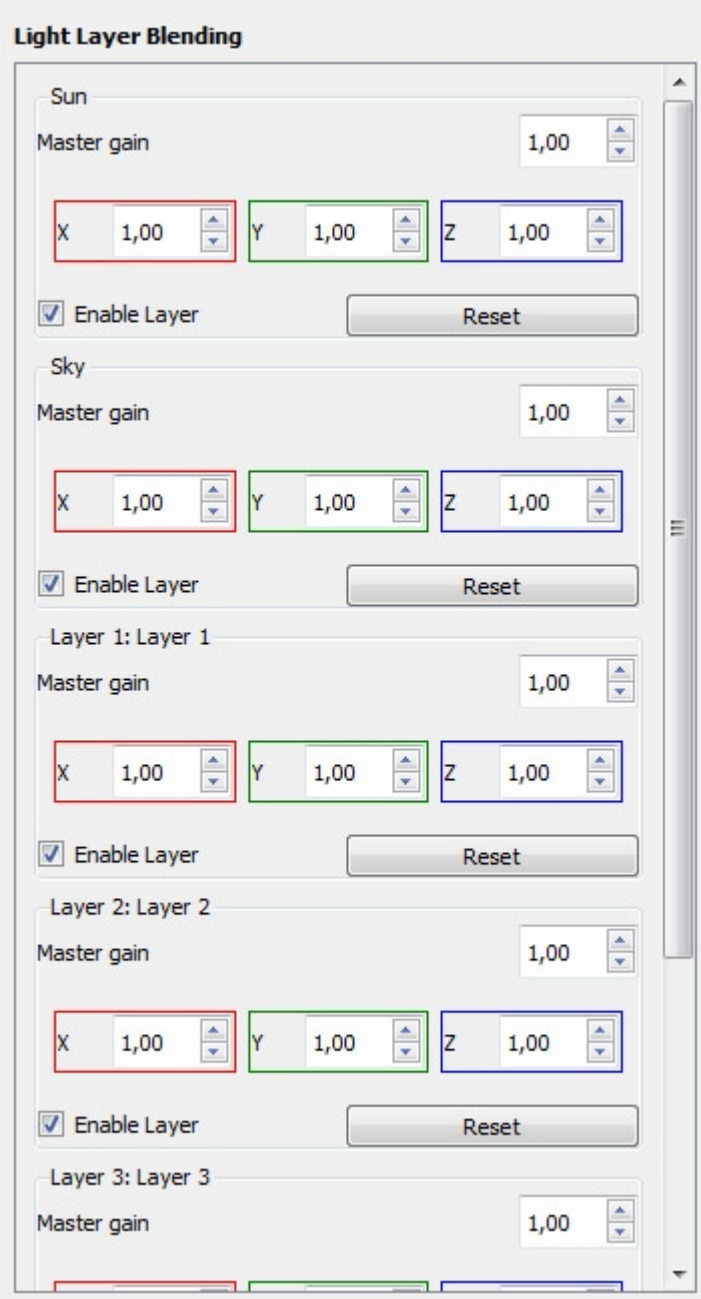
The white balance is specified using x and y chromaticity coordinates. These should be matched to the chromaticity of the scene lighting as closely as possible.

You can also set the whitepoint coordinates indirectly, by selecting a whitepoint preset from the 'Preset' drop-down box. The list contains the whitepoint coordinates for various different standard illuminants.

For example, if you are lighting your scene with a 'perfectly white' light (e.g. a flat spectral power distribution), you will want to select the 'E' preset.

If your scene uses the sun+sky model, then the 'D65' preset is a good choice, as it corresponds to a noon daylight illuminant.

Light Layers



Light layers allow you to separate contributions from different lights onto different 'layers'. Each layer can then be manipulated separately, even after the render has completed.

You can change the brightness of each layer, or change the overall colour of each layer, or even turn each layer off completely.

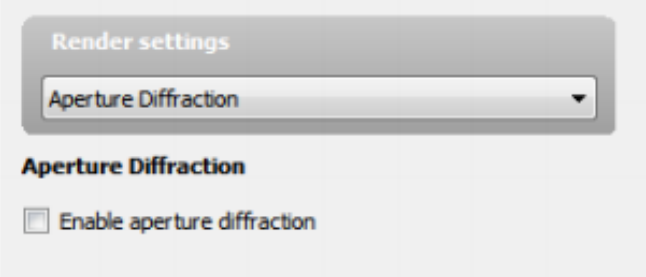
Enabling Light Layers

By default, all lights in an Indigo scene are assigned to layer 0. This means that the HDR image will have only one layer – layer 0. However, in the exporter for your 3D modelling program, you can change the layer that a light is assigned to. All contributions from that light will then be rendered onto that layer.

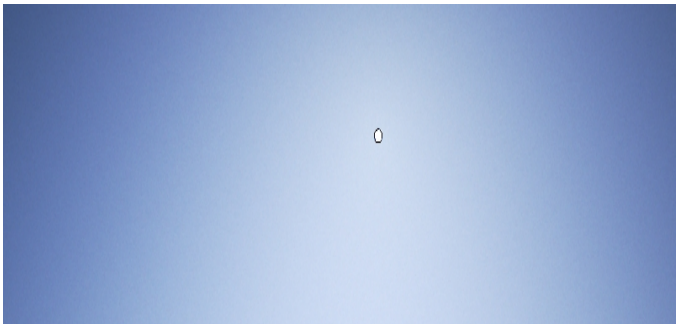
Each layer has a number of controls that you can manipulate in the Indigo GUI. These controls are described below:

Master Gain	Applies an overall scaling factor to the layer. Increasing this value past one makes the layer brighter than originally.
X gain	Scales the X component of the layer, which is similar to the red component of the layer.
Y gain	Scales the Y component of the layer, which is similar to the green component of the layer.
Z gain	Scales the Z component of the layer, which is similar to the blue component of the layer.
Enable Layer	This checkbox allows you to easily turn on and off all contributions from this layer to the final blended image. If it is disabled, this layer will not be added to the final image, and no lights assigned to this layer will be visible.

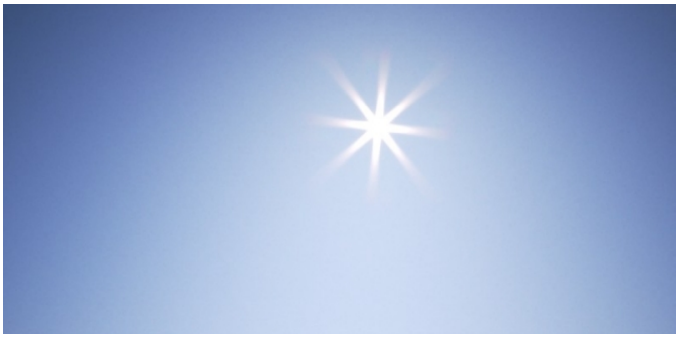
Aperture Diffraction



Aperture diffraction allows the simulation of light diffraction through the camera aperture. Such diffraction creates a distinct 'glare' effect around bright light sources in the image. In the following images, you can see the difference aperture diffraction makes:



Render of the sky and sun, with aperture diffraction disabled

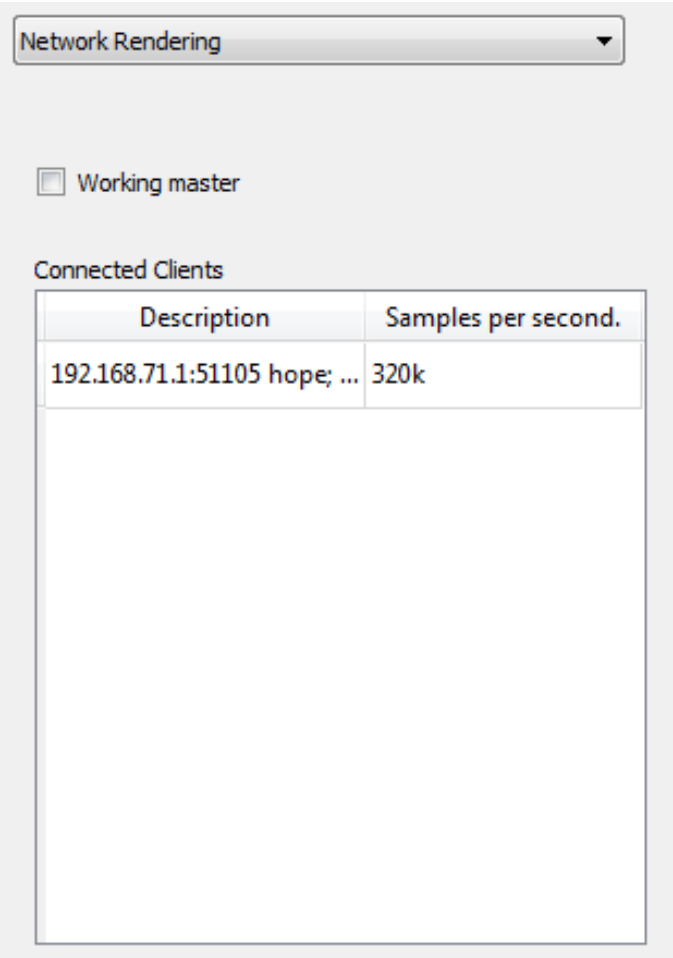


Render of the sky and sun, with aperture diffraction enabled

You can enable or disable aperture diffraction by checking or unchecking the 'Enable aperture diffraction' checkbox.

Note: Aperture Diffraction increases dramatically the amount of RAM used.

Network Rendering

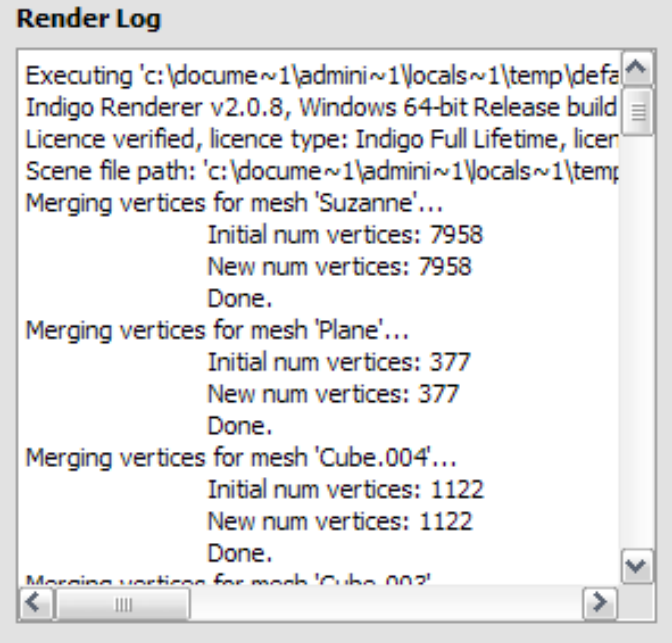


Indigo can be made to render much faster by using several computers at once. This tab shows the current 'render nodes' that are connected to your computer and are helping Indigo render the image faster.

The 'Working master' button specifies whether or not this computer should use its own processor to render the scene – or if the computer should purely manage the render nodes that will do the rendering for you.

See the section on 'Using Network Rendering with Indigo' for more information on this section.

Render Log



The render log shows you messages from the core rendering engine inside Indigo. You do not normally need to access the rendering log. You may want to refer to the log to get an idea of how many triangles in your scene or what Indigo is doing at each stage of the render to satisfy your curiosity.

The render log can be valuable if you are using Indigo's advanced features or are experiencing strange errors with a pre-release version of Indigo.

Indigo File Types

Indigo has several of its own file types for use specifically with Indigo.

IGM: Indigo Material. Contains material information, but nothing else.

PIGM: Packed Indigo Material. Contains material information and anything else relevant to the material, such as textures. Can be upzipped with compression programs such as WinZip, WinRar, or 7Zip. Use to distribute materials.

IGI: Indigo Image. Contains information saved from an Indigo render. Used to resume renders.

IGS: Indigo Scene. Contains information on an Indigo scene.

PIGS: Packed Indigo Scene. Contains everything needed to render a scene, such as models and textures. Can be upzipped with compression programs such as WinZip, WinRar, or 7Zip. Use to distribute or archive scenes.

Rendering a Test Scene

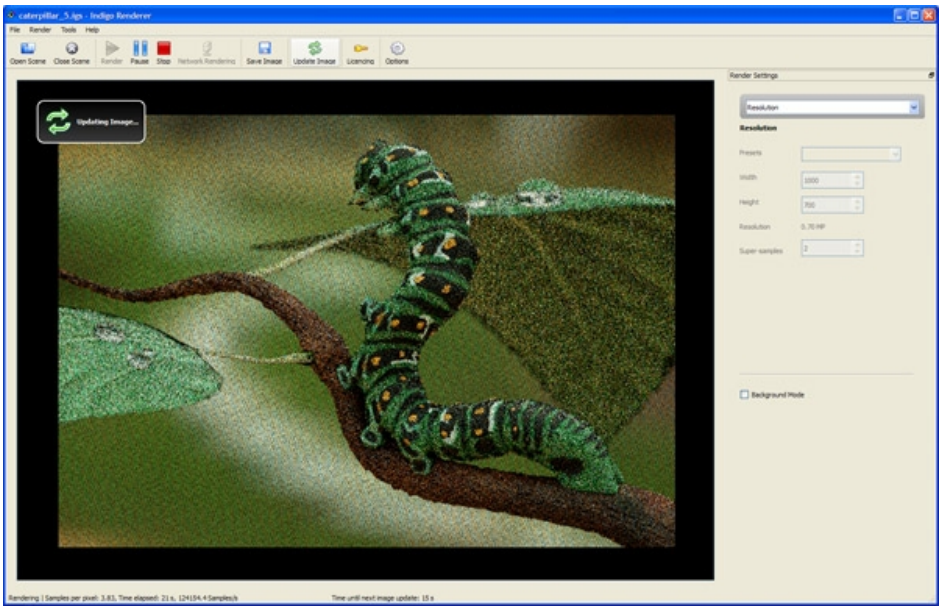
To get a feel for Indigo – click *Open Scene* and browse to the *testscenes* folder your Indigo Render install, likely *C:\Program Files\Indigo Renderer\testscenes* and open the *\Caterpillar - Paha Shabanov\caterpillar_5.igs scene.* This is a winner of a past Indigo competition by Paha Shabanov.

Using the resolutions settings on the right hand side of the window, set the resolution to 800x800 and then press the *Render b*utton on the tool bar.

Indigo will now 'build' the scene and prepare it for rendering. For a simple scene, building the scene will be nearly instantaneous, but for larger scenes (with many millions of polygons), building the scene can take up to a minute. You can tell if Indigo is building the scene because the status bar at the bottom will say 'Building Scene...'.

Once the scene has started rendering, the status bar will update to say 'Rendering | Samples per pixel:...'. This means that Indigo is tracing light rays around your scene and you can start to see the results of your render.

After a few seconds of rendering, press the *Update Image* button on the toolbar. You should see the render looking something like this:



Caterpillar after a short period of rendering

The image will be noisy for the first few minutes of rendering, then will be much clearer. The image displayed will update automatically every so often –

but you can force the image to update at any stage by pressing Update Image on the toolbar.

Next you should use the render settings dropdown to change to Tone mapping. The default setting for this scene is Camera with FP900Z. Click on the ISO box and change the ISO value to 1500, you should see the scene instantly become brighter.



A brighter caterpillar

Next – press pause on the render. The render is now paused, but you can still change the tone mapping settings – press the reset button on the tone mapping controls and the image will return to its normal brightness. Now click the 'Camera' dropdown and change to the 'Reinhard' method.

Change the Prescale to 10 and the Postscale to 30. The image will now look like it has been captured with an auto-exposure.

Change the tone mapping method back to Camera and set the ISO back to 800 then use the render settings dropdown to go to 'white balance'. Using the white balance preset, change the preset to D75, notice that the scene becomes slightly yellow-tinged. Next, change the whitepoint x to 0.35 – notice that the scene becomes notably greener.



Press reset to reset the scene to a default white balance.

Now – press 'Save Image' on the toolbar. Save the image to your desktop as caterpillar.jpg – specify JPG as the file type in the dropdown menu at the bottom of the dialogue.

A useful technique when rendering is to pause the render, try different tone mapping settings and use 'Save Image' to save multiple variations of the render.

Saving and resuming a render using an IGI

While Indigo is rendering a scene, you can save the HDR buffer into an *Indigo Image (IGI, extension .igi)* file.

Along with the original scene file, the IGI file contains all the information needed to resume rendering the scene, from the point where the IGI was saved.

You can resume rendering the scene even after closing Indigo and opening it again later.

To resume rendering an image saved to an IGI, follow these steps:

1. Start rendering the scene. When you wish to save the IGI:
2. Click the 'Save Image' button.
3. Select the *Indigo Image file* type in the *Save File* dialog.
4. Choose a filename for your IGI file, for example 'test.igi', and click *Save.*
5. You can now close Indigo.
6. When you wish to resume your render, open Indigo, and select *Resume Render from IGI* from the *File* menu:
7. You will then be prompted to locate the scene file. This is because Indigo needs to know both the location of the scene file, plus that of the IGI, in order to resume the render. You must open the same scene that you were rendering when you saved the IGI.
8. After selected the scene file, you will be prompted to locate the IGI file. Navigate to where you saved the IGI file, and press the 'Open' button after selecting it.
9. You can confirm that the render resumed successfully by looking at the status bar – the *time elapsed* value should include all the time spent rendering, before the IGI was saved.

Network Rendering

Indigo has built-in support for network rendering, which allows all the computers on a network to work together to render a single Indigo scene more rapidly.

You will need one *master* computer, that will coordinate the rendering process.

You will also need one or more *slave* computers, that will be helping to render the scene. For the purposes of this tutorial, the slave computers must be on the same local area network (LAN), and able to communicate with each other.

On the master computer:

Step 1: Start Indigo Renderer (indigo.exe).

Step 2: Open the scene that you want to render in the Indigo Renderer GUI using the "Open Scene" button.

Step 3: Press the 'Network Rendering' button to enable network rendering mode.

Step 4: Press the start render button

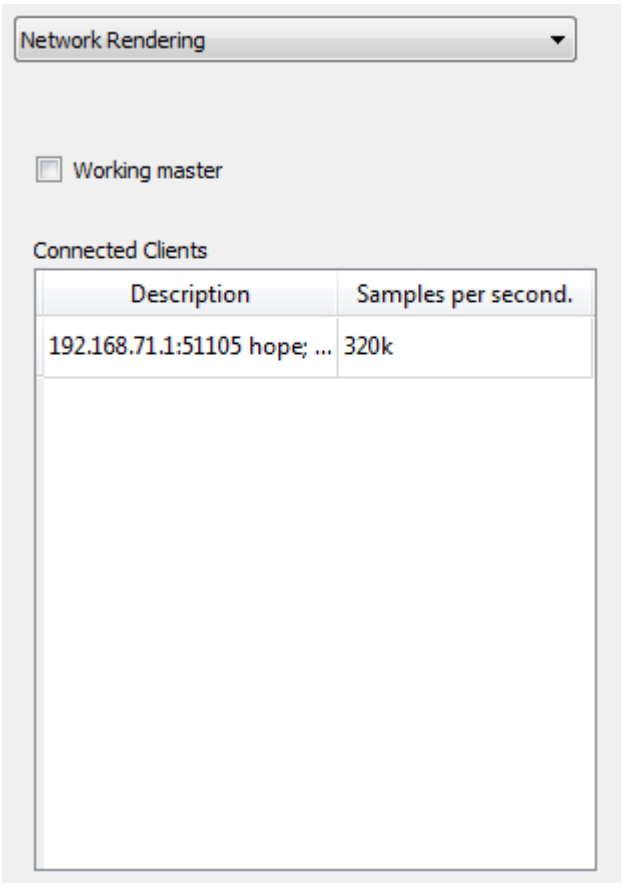
On the slave computer(s):

Step 1: Execute the "Indigo Network Render Slave" shortcut.

Providing the network slave can find the master and connect to it on the network, it should then download the scene from the master and start rendering it.

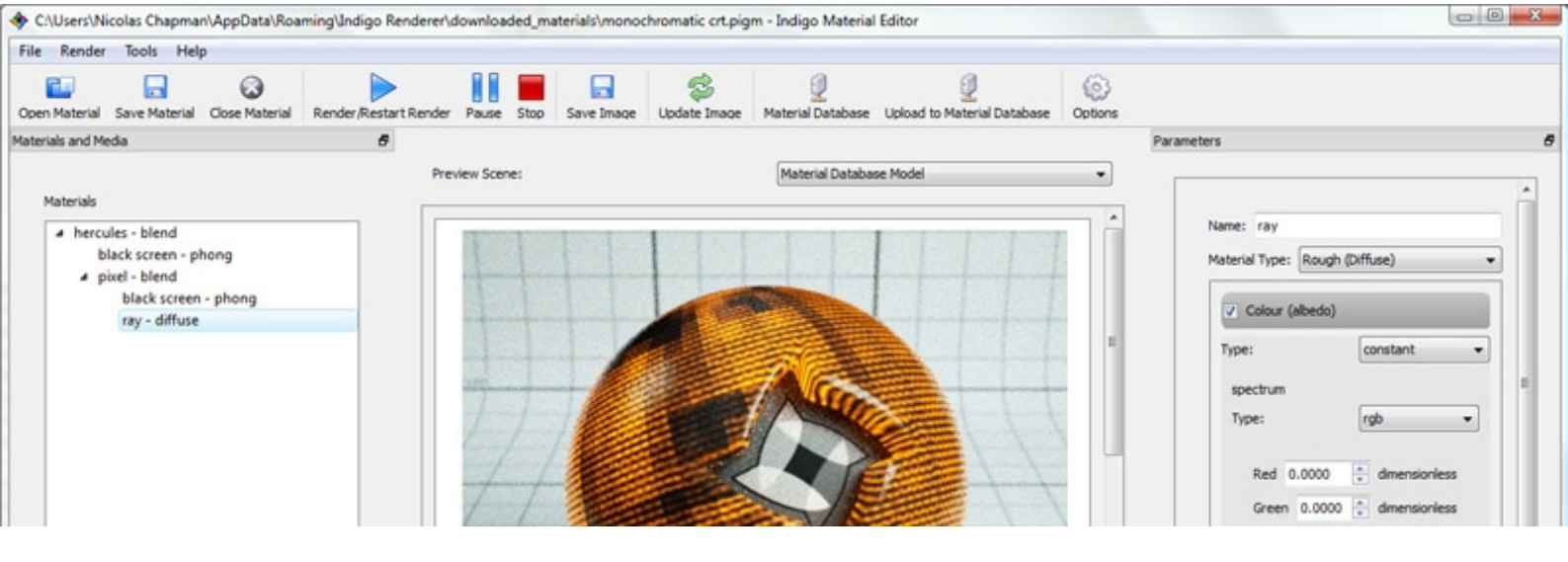
Viewing connected slaves on the master GUI

You can view all network slaves that are helping with the current render by selecting "Network Rendering" from the combo box on the right hand edge of the Master GUI:


Network Rendering
Working master
Connected Clients
Description
Samples per second.
192.168.71.1:51105 hope; ...
320k

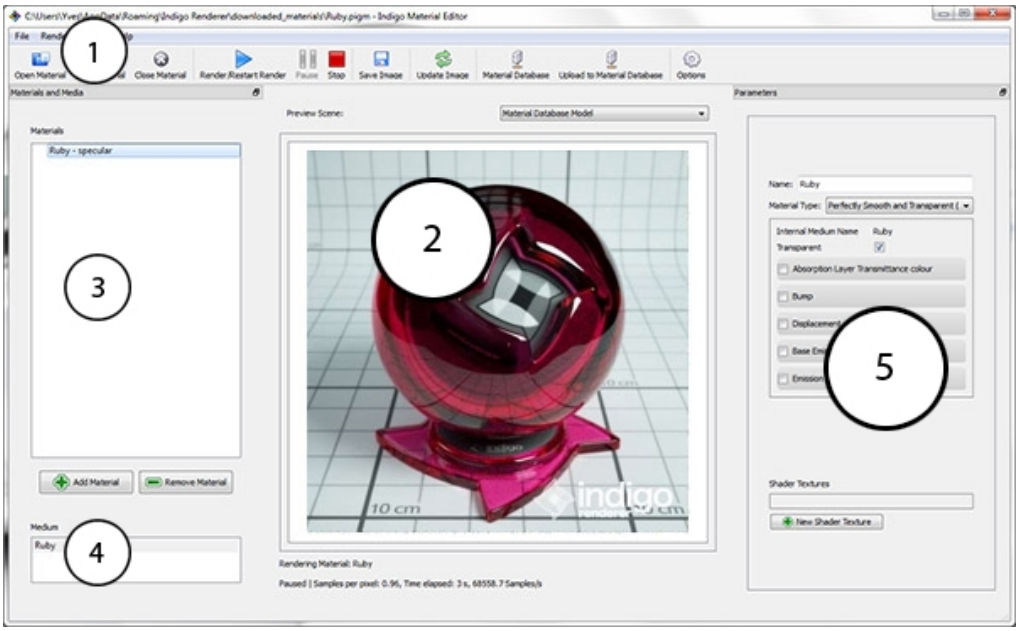
Working with the

Indigo Material Editor



The Material Editor

The Indigo Material Editor is a controlled environment to aid the process of creating materials for your scenes. While all the controls are available in your exporter, it is much quicker to make iterations of your materials and easier to see the results.
This section covers the usage of the Indigo Material Editor's interface only. See the Indigo Material section below for information on material attributes.



The Indigo Material Editor

1. The standard Indigo toolbar with two extra options – Material database, and Upload to Material database.

2. The preview panel. Rendering progress is displayed here. After your first render, you can view your past renders by scrolling down here.

3. The materials panel here lists all material types used on this single material.

4. The medium panel lists mediums that the material is currently using

5. The control panel. Here you can adjust the material type and its attributes depending on what is selected. Also displays the medium's attributes when a medium is selected.

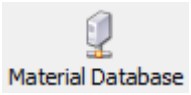
1. Toolbar

See Indigo Toolbar for the full toolbar.



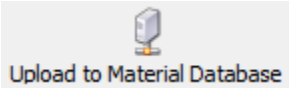
Render/Restart Render

This button differs slightly from the Indigo Renderer, in that it can either start a new render using any material changes you have made, or resume the current render. You must stop a render in order to start a new render with different settings.



Material Database

This new feature allows you to browse the Indigo Material Database hosted on the Indigo website through the Material Editor. All these materials are submitted by the community and all materials are Creative Commons Licensed and can be freely used in commercial work. Downloading the material instantly downloads it and places it in the material editor. Note: Downloading a material replaces the current material open.



Upload to the Material Database

This will take your current render, and current material settings and upload it to the online Indigo Material Database with a form for you to fill out describing it. The Material Database model must be used when uploading to the data base and it is strongly suggested that the render of your material is clear and easy to see.

2. Rendering frame

Rendering your material using the **Render/Restart Render** will draw your material applied to the default Material Database model here. Subsequent new renders will push old ones down below and start above. To view old material renderings, just scroll down here. Note: only the newest render will be saved using the **save image** button, and any old ones will be lost when the program is closed.

3. Materials List

Here is a list of all the currently used material types. If blended materials are used, this also shows the hierarchy.

Add Material: Adds a new default material to the current list.

Remove Material: Deletes the selected material.

4. Medium

This shows the medium being used. Using a material type (specular or glossy transparent) that has a medium automatically adds it down here. A material can only have one medium present.

See Medium.

5. Control Panel

Use this to describe the type of material you want. The drop-down is a selection of material types, which affects the attributes that are available below.

See Materials.

Working with

Scenes for Indigo



Indigo Scenes

This section explains all the special features that Indigo offers to enhance the scenes you create within your 3D package. If you have been using an Indigo exporter, such as Cindigo, Blendigo, SkIndigo, or MaxIgo, and are unsure what some features do, you've come to the right place.

There are 2 main sections that you will work with in order to get good renders with Indigo: Materials, and the Render Settings. Indigo materials allow you to add in all the extra details that most renderers are not able to simulate, and the Render Settings allow you to control how the scene is rendered.

Materials

Indigo has 7 different material types. Each one represents a different physical material. When light strikes and object, it interacts with it in some way, reflecting or penetrating the material. Indigo material types define what the light does on the surface and inside it, giving you all the controls to tell the light what to do. This section will go through each material type and its attributes and will also include the several miscellaneous types such as Exit Portals and Nulls.

Materials are rendered using the Material Editor with the default Material Database Model for clarity.

Material Attributes

Each material has attributes that control aspects of itself. There are a several common attributes, as listed here, and unique attributes, as listed under their respective Material Type. All attributes can be controlled by either a single number, a Texture, or a shader.

Here is a list of the shared material attributes.

Albedo

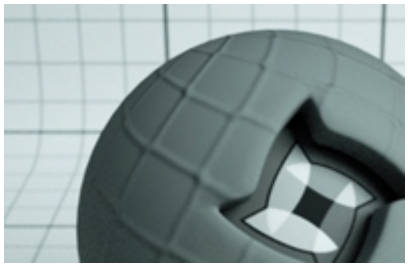


Defines the color of the surface.

See the Texture Maps section for information on texture attributes.

Materials with attribute: Diffuse, Phong, Diffuse transmitter, Oren-Nayar

Bump



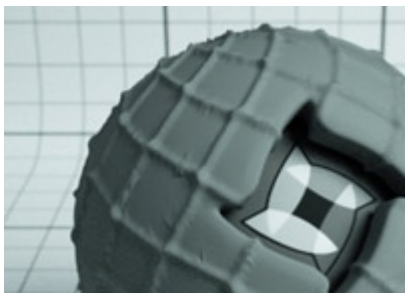
Gives the illusion of a bumped surface by creating highlighted and shadowed areas based on a texture map. It does not actually displace the surface at all. Good for small details and renders faster than displacement maps.

The scale value (B) tells Indigo how far the distance is from full black to full white. Because bump maps do not actually change the surface, a low number is suggested in the range of several millimetres, otherwise smooth gradients can become harsh lines.

See the Texture Maps section for information on texture attributes.

Materials with attribute: Diffuse, Phong, Specular, Glossy Transparent, Oren-Nayar

Displacement

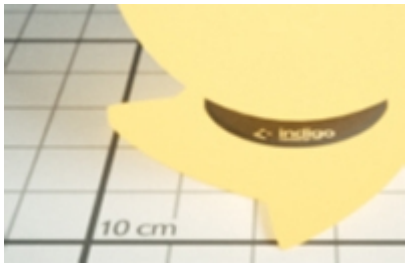


Creates 'real', or 'physical' bumps on a surface. Most commonly created by use of a texture map. Can be used for anything from small details such as a rough surface, through medium details such as brick, and even for mountain ranges.
A constant setting displaces the entire mesh evenly by the defined amount. A texture map displaces the vertices based on values in a grey-scale image.

See the Texture Maps section for information on texture attributes.

Materials with attribute: Diffuse, Phong, Specular, Glossy Transparent, Diffuse transmitter, Oren-Nayar

Base Emission



Emits a specified brightness and color of light, use this to create lights. There are several modes to set this:

RGB: Light based on color and brightness.
Uniform: A white light with intensity based on value given.
Blackbody: Light is based on the temperature. Measured in Kelvin.
Peak: Define the limits of the wavelength.
Real Tabulated: Allows nearly arbitrary spectra to be defined. The spectrum value is given at regular wavelength intervals, and linear interpolation is used to sample at intermediate wavelengths.

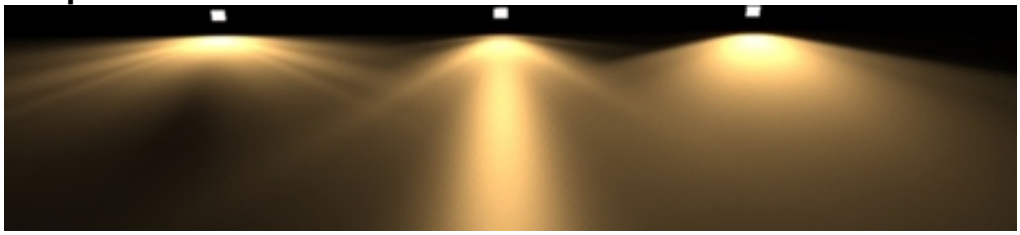
Materials with attribute: Diffuse, Phong, Specular, Glossy Transparent, Diffuse transmitter, Oren-Nayar

Emission

Modifies the Base Emission value. The final emission is based on the Base Emission and Emission. Emissions are measured in Lumins

Emission Scale: Scales the emissions from the material by given scale. Various photometric units are available.

IES profile



If an IES profile is selected, then the emitted light has a particular pattern based on the information in the IES profile. This is an easy way to get light as emitted from a realistic light fixture, without all the modelling. Only IES files with vertical angles below 90 degrees are supported.

See the Texture Maps section for information on texture attributes. Also see the IES tutorial in the Techniques Manual.

Materials with attribute: Diffuse, Phong, Specular, Glossy Transparent, Diffuse transmitter, Oren-Nayar

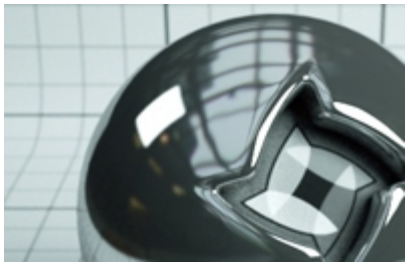
Layer

Choose the layer that the light reflected/transmitted from this material will be recorded onto. Used for creating several different lighting set-ups to render at once.

See Light Layers, and Techniques Manual: Light layers

Materials with attribute: Diffuse, Phong, Specular, Glossy Transparent, Diffuse transmitter, Oren-Nayar

Exponent



Controls the 'roughness' of the surface. The smoother the surface (or higher the exponent), the sharper the reflection. Higher exponent means more 'perfect' reflection, lower exponent leads to more glossy and diffuse highlights. Can range from ~1 to up to 10000 or more.

Materials with attribute: Phong, Glossy Transparent

Texture maps



Unadjusted texture

Supported texture formats:

JPEG (.jpg, .jpeg): greyscale, RGB supported.

PNG (.png): greyscale (8 or 16 bits per pixel) , RGB (24 or 48 bits per pixel) supported. Note that 16 bits per channel data will be internally converted to 8 bits per channel data.

Truevision TGA (.tga): greyscale (8 bits per pixel) or RGB (24 bits per pixel) supported. RLE compression is not supported.

Windows Bitmap (.bmp): greyscale (8 bits per pixel) or RGB (24 bits per pixel) supported. RLE compression is not supported.

Open EXR (.exr)

TIFF (.tif / .tiff): greyscale, RGB, RGBA supported.

UV set: Name of the set of uv coordinates used for texture lookup. Usually generated by your 3D package plugin.

Path: Path to the texture map on disk. Path must be absolute or relative to the scene working directory.

Gamma (Exponent): Used for converting texture RGB values to display values. A typical value is thus 2.2.

A,B,C Values

The A, B, C values are modifiers for the texture map. This is the equation used (for those that have studied calculus this equation will be familiar):

$x = ax^2 + bx + c$

The A, B, C, values are taken from here. Thus:

A value – Quadratic

Scales values by a quadratic, so low values stay low, and larger values become exponentially larger. You will not often need to use this, usually it easier to get expected results by modifying the texture map with an image editing program.

B value - Scale/Multiplier

Scales the texture map values. Can be associated with contrast. Maps the value range of 0-255 to 0-1 (for a usual LDR texture), which is then multiplied by this number. For example: a **B** value of 2 makes a pure red RGB 255,0,0 to 510,0,0.



Texture Scale(B) of 2

C value – Base Value

Total RGB offset, generally making the texture brighter or darker.

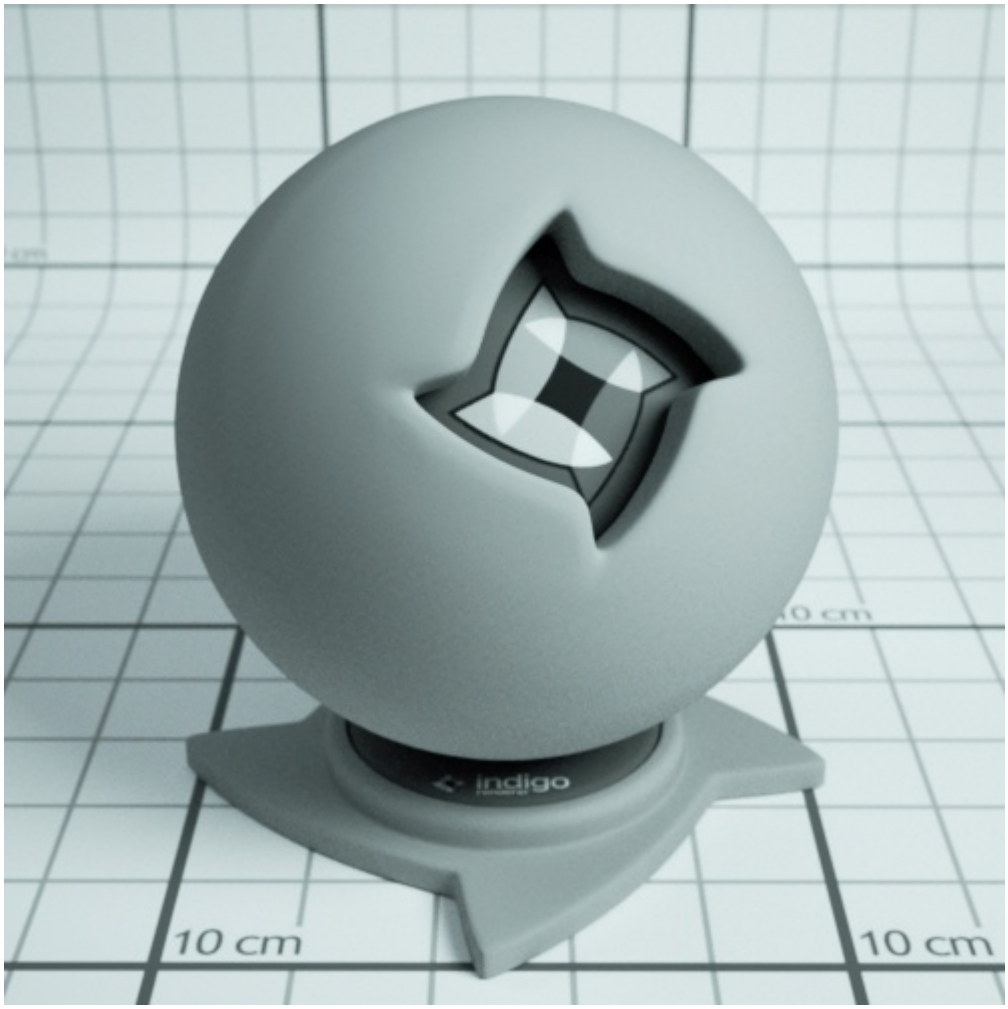


Texture base value(C) of 0.2

Indigo Shader Language

ISL stands for Indigo Shader Language. Its a functional language that allows you to write shaders for every channel in Indigo materials. With shaders you are not tied to the restrictions of textures any more: they are procedurally computed for every point on the surface.

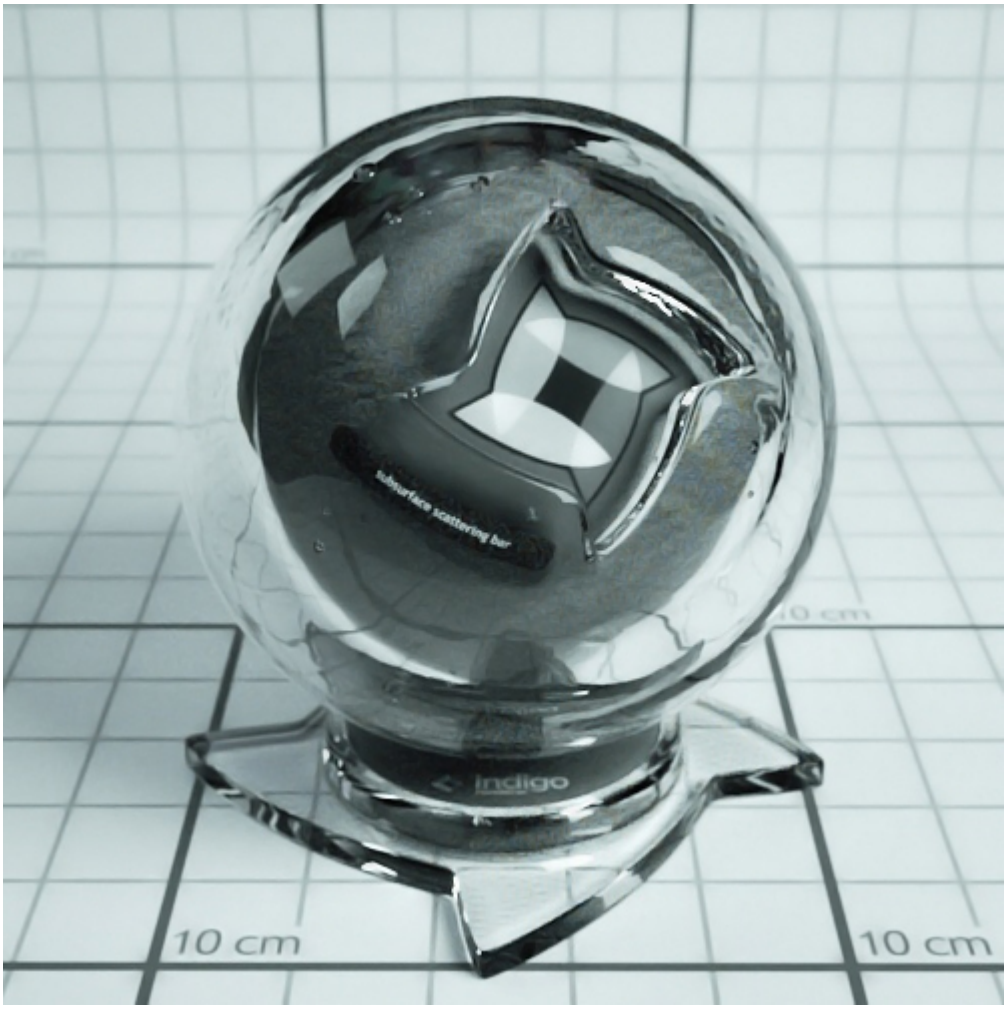
Diffuse



Diffuse materials are flat, matte surfaces that don't have shiny edges. Flat wall paint, or a piece of paper are good examples of a diffuse material. There will be no particular reflection from a diffuse material.

Common attributes: Albedo, Bump, Displacement, Base Emission, Emission, Layer

Specular

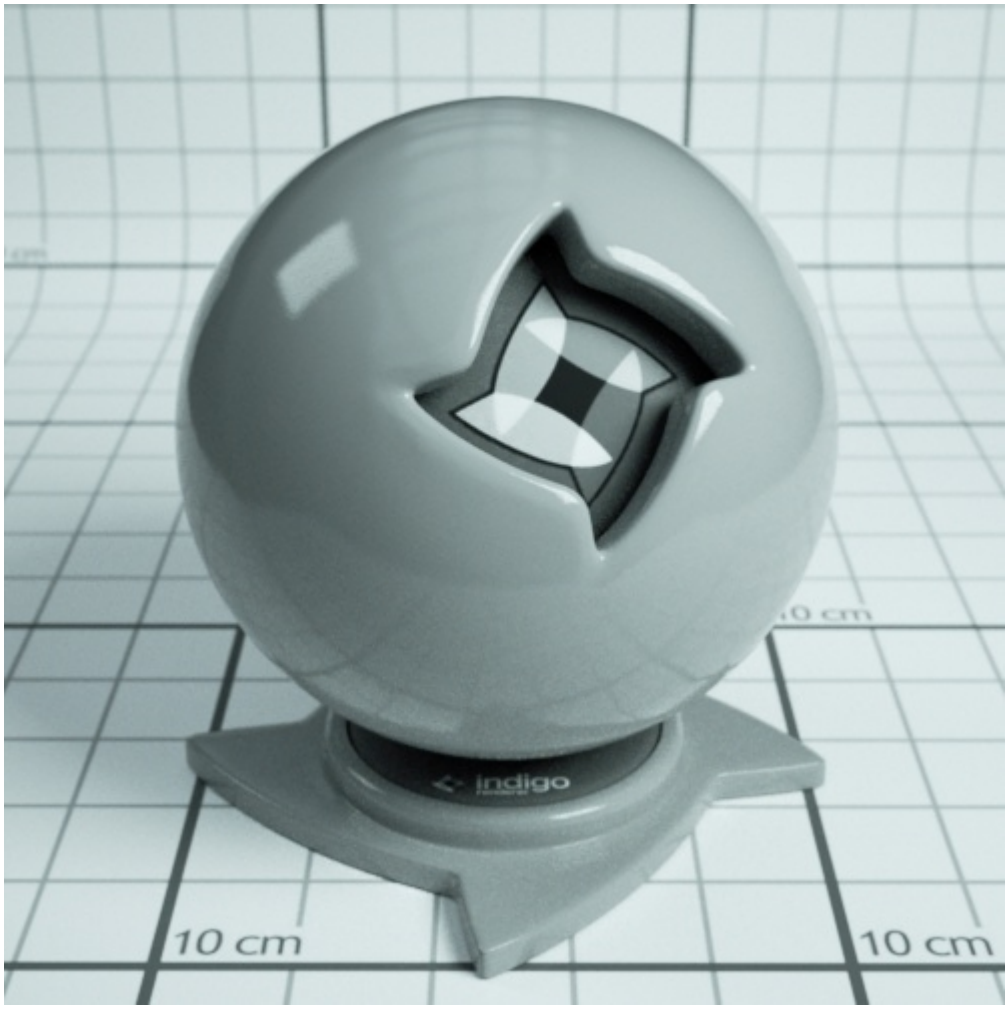


Specular materials are quite powerful and can be made to act as perfect reflectors (like a mirror) or as a fully transparent glass and anything in between. If transparent, the medium defines how the light moves through the object, scattering and/or absorbing.

Transparent: If enabled, it allows light to pass through the material. Otherwise only reflected light is simulated.

Common attributes: Internal Medium, Bump, Displacement, Base Emission, Emission, Layer

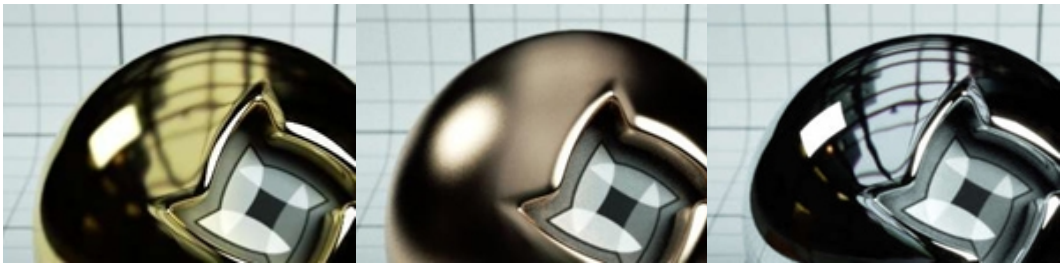
Phong



Phong is a shiny material. Commonly used for shiny paints or any metals. In particular, phong will have a "specular highlight" where the light is completely reflected. Phong is useful for anything that has a lacquer applied to it - for example a shiny wood floor or a car paint.

IOR (Index Of Refraction): of the dielectric coating or substance making up the material. Basically controls the amount of light reflected by the surface. The amount of light reflected.

Nk_data: Indigo comes packaged with a set of Lab-measured metals. Use this attribute to set a metal to the material. If Nk_data is used, then the Diffuse and Specular attributes are ignored.

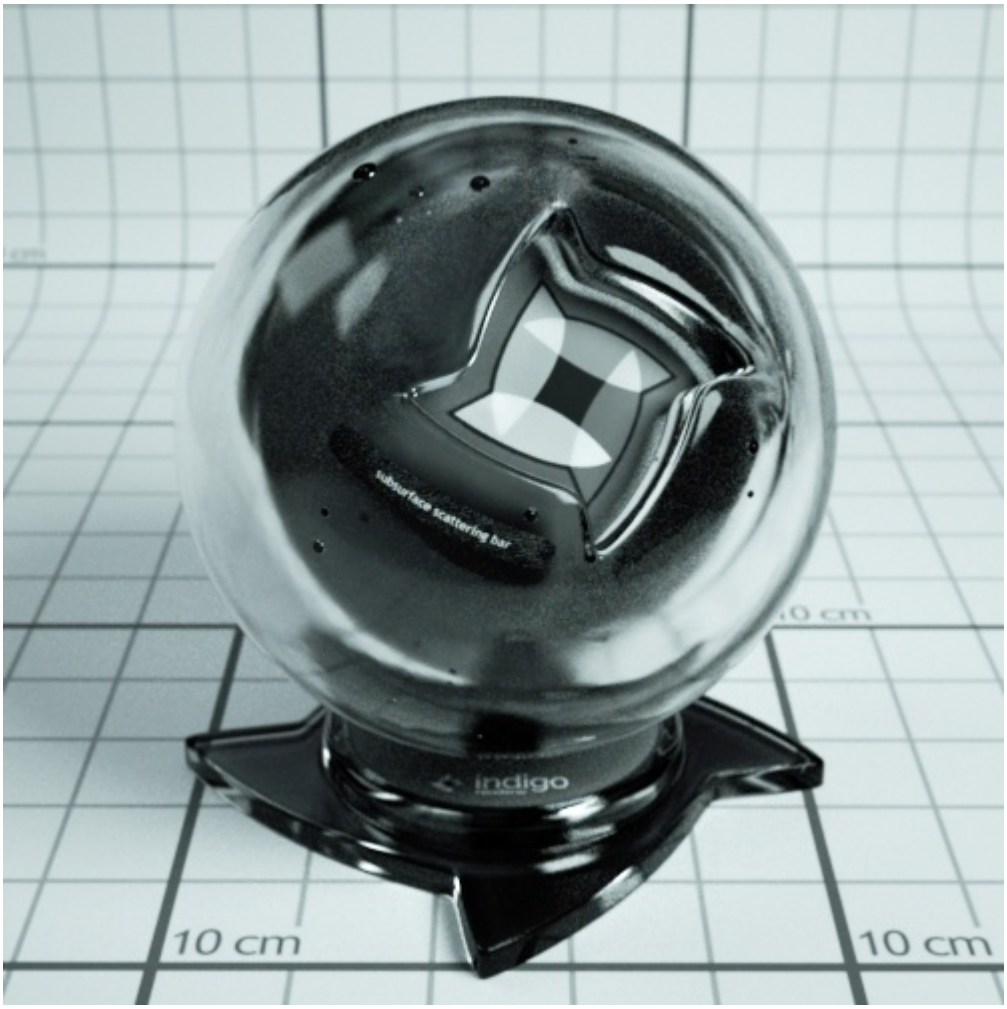


Various Nk_data profiles

Specular Color: Generally speaking, this changes the color of the reflections**.** If this is enabled, then IOR and Albedo are ignored. It is therefore only good for simulating metals.

Common attributes: Albedo, Exponent, Bump, Displacement, Base Emission, Emission, Layer

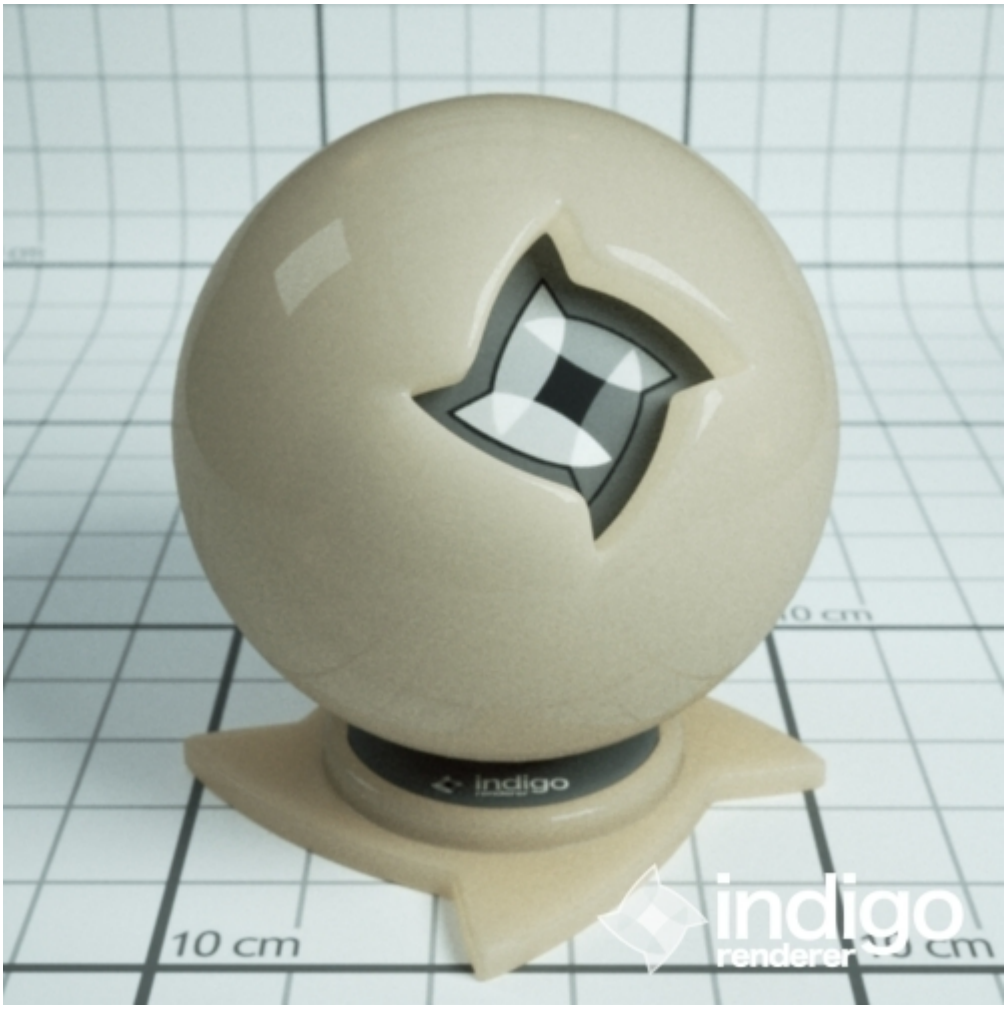
Glossy Transparent



The glossy transparent is a material that simulates a rough surface of a transparent dielectric medium. It's good for simulating stuff like frosted glass, human skin etc.

Common attributes: Internal Medium, Exponent, Bump, Displacement, Base Emission, Emission, Layer

Diffuse Transmitter

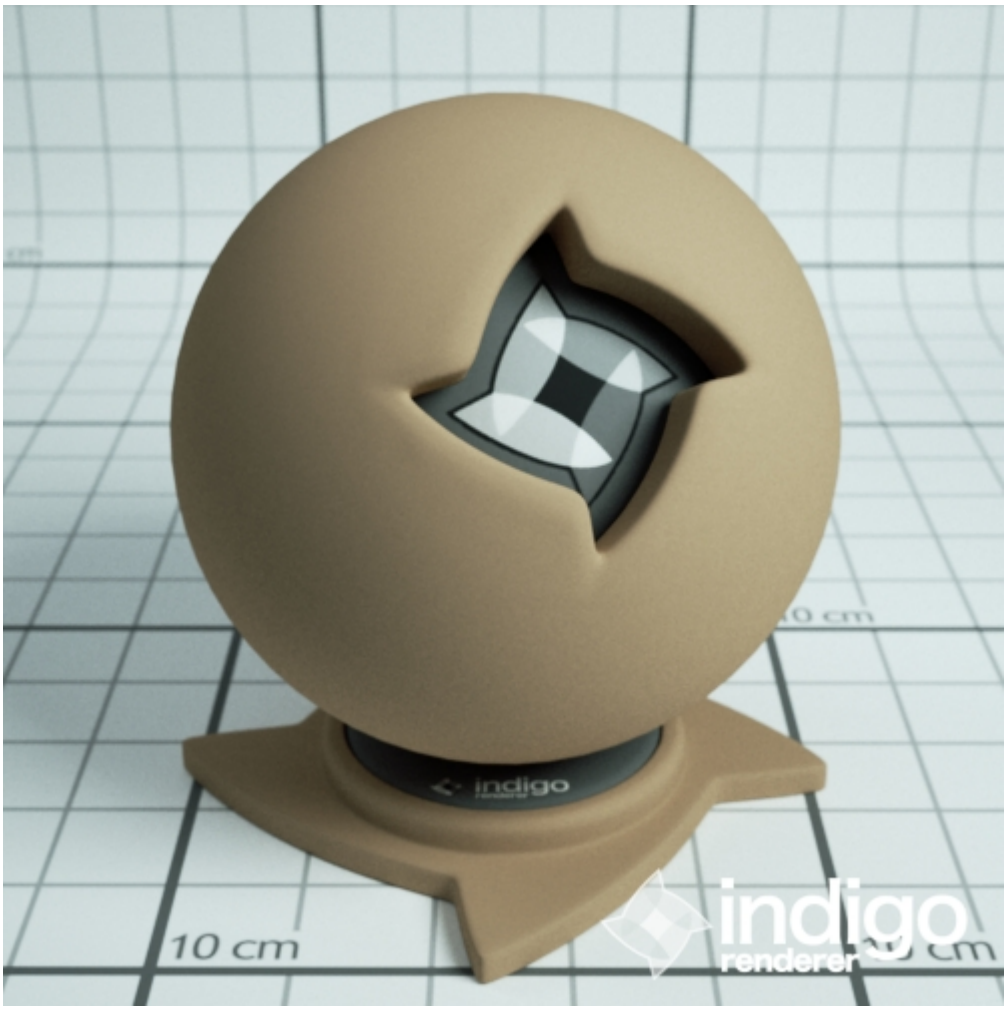


Note: Image shows a blend of diffuse transmitter and Phong materials

This material is a very simple BSDF that basically scatters incoming light into the opposite hemisphere, with a cosine-weighted distrubution.
Although it doesn't really have any exact physical basis, it could be thought of as the limit of many sub-surface scatters inside a thin, highly scattering material. As such it should be useful for simulating such materials as curtains, lampshades etc..
It's meant to be used on single-layer geometry, and it does not have an associated internal medium (it's not an interface material).
It will probably be a good idea to blend this material with a diffuse or phong material, so that some backscattered light is visible, not just transmitted light.

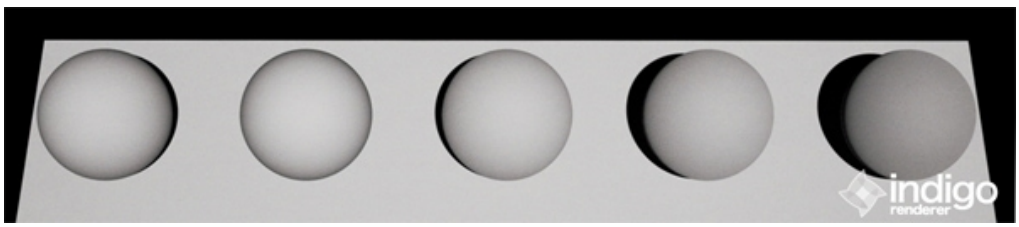
Common attributes: Albedo, Displacement, Base Emission, Emission, Layer

Oren Nayar



Oren-Nayar materials are very rough materials that scatter light in every direction. They are rougher than diffuse materials. Oren-Nayar is useful for creating surfaces that are like clay. They aren't shiny at all.

Sigma: Controls the roughness of the material. A higher sigma gives a rougher material with more backscattering.

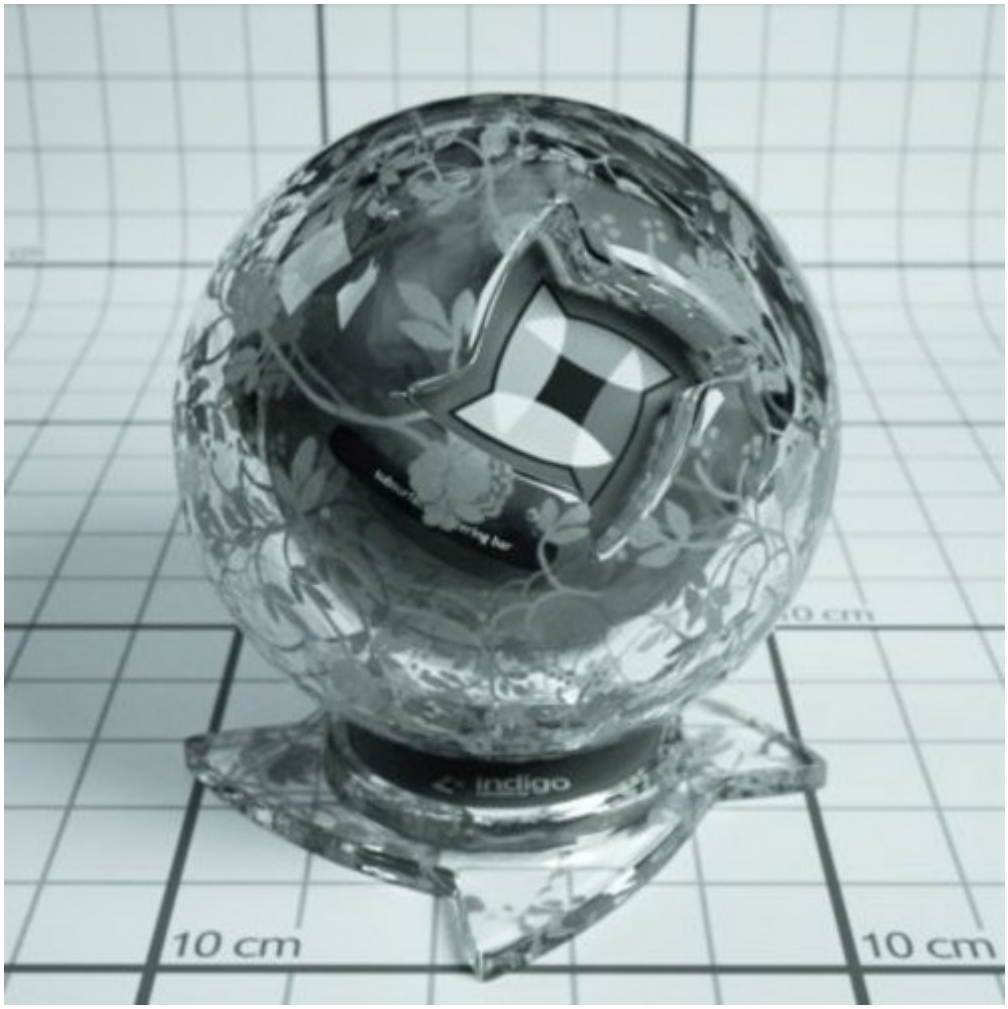


Diffuse Material; Oren-Nayar Material with Sigma: 0.0, 0.2, 0.5, 1.0

Notice with the increasing Sigma, the rim shadows disappear, and the overall brightness fades.

Common attributes: Albedo, Bump, Displacement, Base Emission, Emission, Layer

Blend



The blend material allows two materials to be blended together, controlled by either a constant value, or an image/texture map. It is possible to blend more than two materials together by arranging them into a hierarchy.

Only restrictions are that you cannot blend null & null, and specular & specular, and null & specular material types.

Blend: Controls the amount of each material used. A value of 0 means only material *a* is used, a value of 1 means only material *b* is used.

Step Blend: Applies a step to the blend amount. Values over 0.5 will become 1, values under 0.5 will become 0. Recommended for clip masks to reduce noise.

Exit Portals

Exit portals are useful for speeding up interior renderings, when the interior is lit by an environmental light source, such as the sun/sky model.

Exit portals are placed over the openings between the interior and the exterior environment. These openings are the 'portals' in the scene.

Exit portals make the rendering process more efficient, because paths passing through such openings can be more efficiently sampled when explicity marked with an exit portal.

Requirements for exit portal usage:

- If exit portals are present in the scene, then all openings must be covered by exit portals. In other words, all possible paths that start on the camera, and then travel through space or a transparent object, and then escape out of the scene into the environment, must be blocked by one or more exit portals.

- The geometric normal (defined by triangle winding order) of an exit portal mesh triangle, where reachable by some path from the camera, must point into the interior of the scene. (i.e. The front side of the mesh faces should be visible by the camera)

Null Material

The null material is a very simple material that doesn't scatter light at all. It's effectively invisible. It is often used to add transparency to materials by adding it to a blend material.

The null material has no parameters.

Internal Medium

The medium attribute fills the interior of the mesh with a medium that diffracts, scatters and absorbs light, depending on the type set. A medium has a type (much like material have types).

Media types include basic, epidermis, and dermis.

Precedence: Precedence is used to determine which medium is considered to occupy a volume when two or more media occupy the volume. The medium with the highest precedence value is considered to occupy the medium, 'displacing' the other media. The predefined and default scene medium, 'air', has precedence 1.

Basic

IOR: Index of refraction. Should be >= 1. Glass has an IOR (index of refraction) of about 1.5, water about 1.33. The IOR of plastic varies, 1.5 would be a reasonable guess.

Cauchy B Coeff: Sets the 'b' coefficient in Cauchy's equation, which is used in Indigo to govern dispersive refraction. Units are micrometers squared. Setting to 0 disables dispersion. Note: the render can be slower to converge when dispersion is enabled, because each ray refracted through a dispersive medium can represent just one wavelength. So only set cauchy_b_coeff to other than 0 if you really want to see dispersion.

Typical values for glass and water lie in the range 0.003 – 0.01

(see http://en.wikipedia.org/wiki/Cauchy%27s_equation for some coefficients)

Absorption Coefficient Spectrum: Controls the rate at which light is absorbed as it passes through the medium.

Subsurface Scattering: Use this element to make the medium scatter light as it passes through it.

Scattering Coefficient Spectrum: Chooses the phase function used for the scattering.

Phase Function

The phase function controls in what direction light is scattered, when a scattering event occurs.

Uniform: Takes no parameters

Henyey Greenstein: The Henyey-Greenstein phase function can be forwards or backwards scattering, depending on the 'g' parameter.

G Spectrum: The g parameter may vary with wavelength, and is therefore specified using a spectrum element. Spectrum, Peak ,Blackbody ,Rgb, Regular Tabulated as defined above.

Epidermis

Medium for simulating the outer layer of skin.

Melanin Fraction: Fraction of melanin present in tissue.
Typical range: 0 – 0.5

melanin Type Blend: Controls the amount of eumelanin relative to pheomelanim in the tissue. Typical range: 0 – 1

Dermis

Hemoglobin Fraction: Controls the amount of hemoglobin present.
Typical range: 0.001 – 0.1

Mesh Controls

Subdivide: Divides each triangle in the mesh into 4, with each level increasing it exponentially. Therefore a large mesh mesh of, say, 1 million becomes 4 million subdivided only once. Twice it becomes 16 million, and three times become 64 million.

Render Settings

These settings effect how Indigo renders.

Logging: If true, a log from the console output is written to log.txt

Save Untonemapped Exr: An untonemapped EXR image is saved in the renders directory.

Save tonemapped Exr: A tonemapped EXR image is saved in the renders directory.

Save igi: An untonemapped Indigo Image (.igi) file is saved in the renders directory.

Image Save Period: The rendered image(s) will be saved to the renders directory this often.

Halt Time: Indigo will stop rendering after this amount of time.

Halt Samples Per Pixel: Indigo will stop rendering after after this amount of samples-per-pixel has been reached.
See Samples Per Pixel

Frame Upload Period: Period between uploads of the image buffer from slave to master when rendering in network mode.

Auto Choose Num Threads: Automatically chooses all available CPU cores for rendering. Turn this off to specify number of threads to use for rendering.

Num Threads: Define the number of threads for Indigo to render with.

Super Sample Factor: If this factor is greater than 1, then the image is rendered at a higher resolution internally, then downsampled using the downsize filter before the render is saved to disk. This can help to reduce aliasing around high contrast edges. Note that higher factors require more memory (RAM).

Display Period: The internal HDR buffer is tonemapped and displayed on screen this often.

Watermark: An 'Indigo Renderer' logo is drawn on the bottom right hand

corner of the output render.

Info Overlay: If true, a line of text is drawn on the bottom of each render, containing some statistics about the current render process.

Cache Trees: If true, kd-trees are cached to disk after construction, in the tree_cache directory.

Aperture Diffraction: There are two options: Physical and Post-process. Physical is calculated during rendering and while it is slightly more accurate than the post-process aperture diffraction, it is slower. Post-process aperture diffraction is suggested.
See Aperture Diffraction.

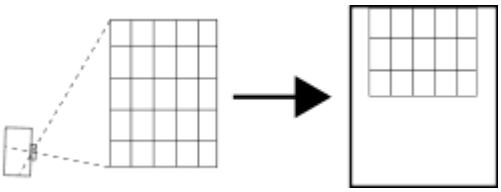
Render Region: Only a certain region of the image is rendered.

Render Foreground Alpha: The output image is just a greyscale image, with the foreground as white, and the background (physical sky, env map, constant background, void background etc..) as black. Intended to be used as an alpha layer for compositing.

Splat Filter: Controls the filter used for splatting contributions to the image buffer. A Gaussian filter with standard deviation of 0.35 pixels. or Mitchell-Netravali cubic filter which is a good all-round filter with little aliasing. Mitchell-Netravali has two variables: blur and ringing. Higher blur values cause more blurring of the image and higher ring values cause more 'ringing'. (alternating bands of black and white around high contrast edges).

Downsize filter: Controls the filter used for downsizing super-sampled images. Only used when Super Sample Factor is greater than one. Takes exactly the same parameters as Splat Filter.

Lens Shift: Shifts the lens to compensate for perspective. From Wikipedia:



(a) Keeping the camera level, with an ordinary lens, captures only the bottom portion of the building.



(b) Tilting the camera upwards results in vertical perspective.



(c) Shifting the lens upwards results in a picture of the entire subject.

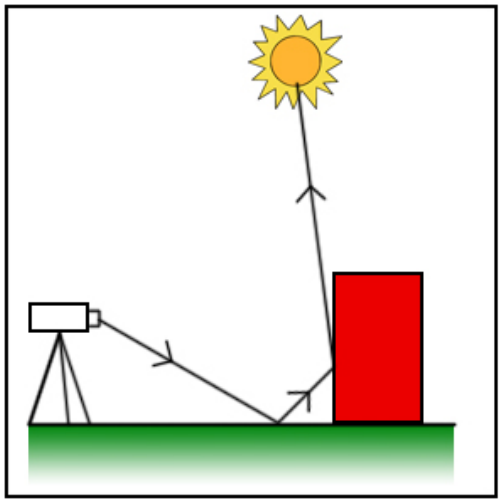
Render Mode

Indigo is a Ray-tracer, which means that it captures scenes by firing out light rays and seeing where they go and what they hit. There are several ways that rays are calculated, with some being better than others in certain situations.

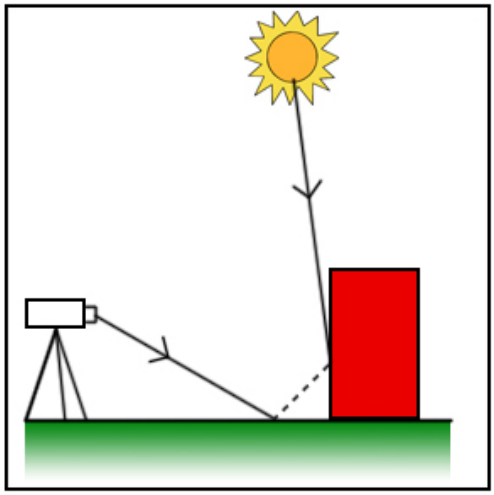
The options are:
BiDir pathtracing
Normal pathtracing
MLT with BiDir
Normal MLT

Generally, **BiDir pathtracing** should be used as it is the best all-round solution.

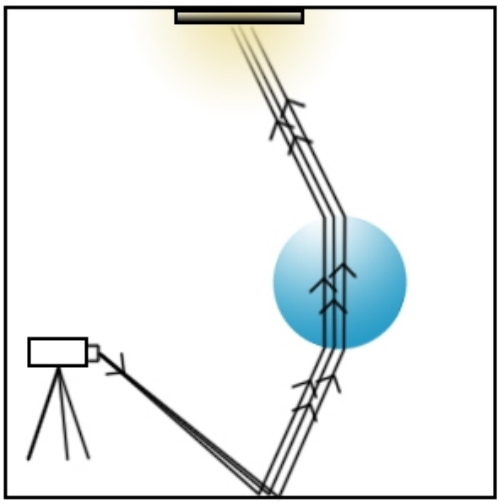
Here is a diagram describing what they do.



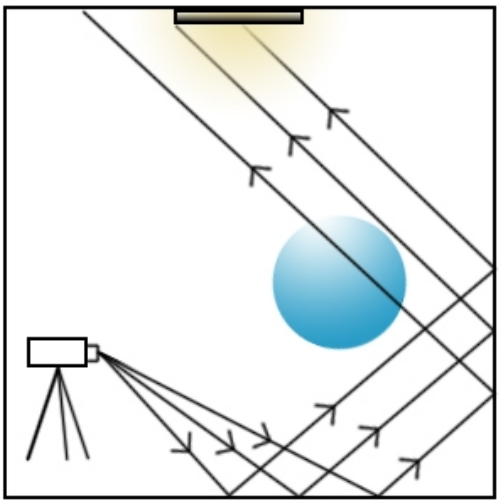
Normal pathtracing



BiDirectional Pathtracing



MLT



Normal (QMC)

Normal Pathtracing: Rays are only fired outwards from the camera, recording what they hit on their way.

BiDirectional Pathtracind: Rays are fired outward from both the camera and light sources. They are then joined together to give a result.

MLT (Metropolis Light Transport): When a ray makes a successful path, another ray is fired off on a slightly similar direction. Gives good results for caustics.

Non-MLT (QMC- Quasi-Monte Carlo): Rays are evenly distributed.

Options available:

	MLT on	**MLT off**
Normal Pathtracing		Good for debugging
BiDirectional	Good for 'tricky' scenes	Best default.

Environment Settings

There are several options that allow you to fill the 'outside' of your scene.

Background

Illuminates scene with a uniform environment light.

Sun and Sky

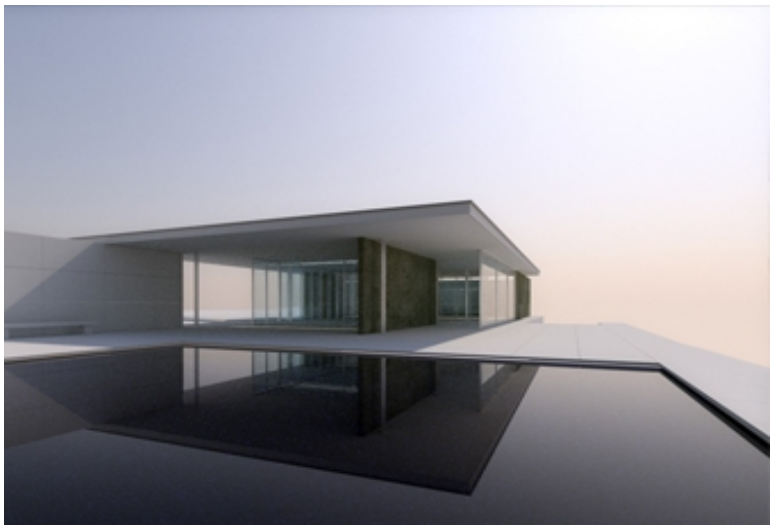


Image by Radiance

Indigo comes with a Sun and Sky model that realistically depicts the sky. Changing the sun's direction creates time-of-day effects: a low angle creates a sunrise/sunset with correctly colored sky and brightness.

Turbidity: The *turbidity* defines the haziness/clearness of the sky. Lower turbidity means a clearer sky. Should be set to something between 2 and ~5.

Extra Atmospheric: Removes the sky and renders only the sun. Good for renders in space.

Environment Map



Image by Fused

Illuminates scene with an HDR environment map.

Indigo can load two types of HDR environment maps, an **.exr**, and a **.float** maps in spherical format. **.float** is a simple format exported by the HDR Shop program. You can define the .float map 's width, but it must be equal to its height.

Gain: The map is scaled by this factor when it is loaded.

Camera

The indigo camera controls how the scene is captured. It not only controls what is rendered, it also contains features found in a real SLR camera, such as the aperture radius and focal distance. These allow for effects such as depth-of-field.

Aperture Radius: Defines the radius of the camera aperture. Larger radius means more depth of field.

Focus Distance: The distance forward from the camera at which objects will appear 'sharp' in focus.

Aspect Ratio: Influences the directions in which rays are traced. Should be set to the image width divided by the image height.

Sensor Width: Width of the sensor element of the camera. A reasonable default is 0.036. (36mm). Determines the angle of view (FOV), together with the Lens sensor distance.

Lens sensor distance: Distance from the camera sensor to the camera lens. A reasonable default is 0.02. (20mm)

White Balance: Sets the white balance of the camera. See White Balance.

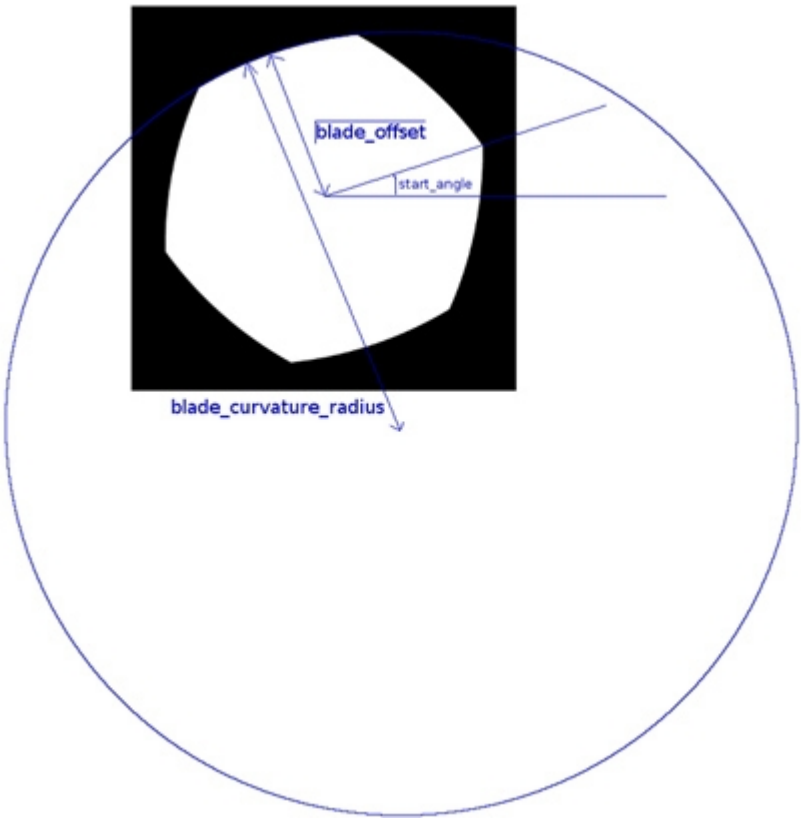
Exposure Duration: How long the exposure will be. The longer the exposure duration, the greater the light energy registered by the sensor.

Autofocus: Sets the focal distance to the distance from the camera straight forward to the first object it hits.

Obstacle Map: An obstacle map texture is used when calculating the diffraction though the camera aperture. Use to change the way the aperture diffraction appears.

Aperture Shape: This allows a particular shape of camera aperture to be specified. The allowable shapes are image, generated, or circular. *A* preview of the final aperture shape will be saved in the working directory as *aperture_preview.png*.

It must be a PNG file format and square with power-of-two dimensions of at least 512 x 512. The image is interpreted as a grey-scale image with the white portions being transparent and the black being solid.



Generated Aperture settings

Going further with Indigo

To learn more about Indigo, we recommend you view the following resources:

- Indigo Renderer website:
  http://indigorenderer.com/

- Our forum for asking questions and learning from the community:
  http://indigorenderer.com/forums/

- The Indigo Technical Reference (a PDF file that comes with your Indigo install) contains an in-depth description of the Indigo file format if you need to edit the XML directly.

- Our free materials database for finding great materials to use in your renders:
  http://indigorenderer.com/materials/

- Our online documentation:
  http://indigorenderer.com/documentation/

We hope you enjoy using Indigo Renderer and look forward to seeing the images that you create!